# Understanding Lifestyle Behaviors and the Development of a Theory-Based Nutrition and Physical Activity Education Intervention for Latina Breast Cancer Survivors

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ABSTRACT

Understanding Lifestyle Behaviors and the Development of a Theory-Based Nutrition and Physical Activity Education Intervention for Latina Breast Cancer Survivors

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Lifestyle behaviors, including diet and exercise, may mediate the risk of breast cancer recurrence. Large national and international organizations, including the American Cancer Society, the American Institute for Cancer Research, and the World Research Fund, recommend consuming a diet high in plant-based foods, specifically fruits, vegetables, and whole grains, and low in dietary fat and added sugar for cancer recurrence prevention. In addition, these organizations recommend regular physical activity, typically 30 minutes of moderate to vigorous activity per day. However, many cancer survivors unfortunately fall short of meeting these recommendations. In addition, low-income, and racial/ ethnic minority populations, especially Latinas, are at increased risk of breast cancer recurrence due to a myriad of factors such as limited access to health care. Theory-based, behaviorally-focused, and culturally-tailored nutrition and physical activity education has been shown repeatedly to improve these lifestyle behaviors in other populations. Previous intervention studies by our research group have significantly improved dietary behaviors among Hispanic/ Latina breast cancer survivors. This dissertation consists of a review of the educational literature on diet and physical activity studies among breast cancer survivors, and three studies: (1) a methodological description on the development of a theory-based, behaviorally focused intervention with classroom and online education curricula, (2) an empirical validation study of a survey instrument, and (3) a cross sectional study of women's diet and physical activity behaviors and theory-based determinants. Taken together, these studies can inform future educational interventions with this population by using our culturally-tailored, theory-based, behaviorally-focused model as a framework and by

using our validated assessment tools. These studies can also inform future educational interventions by understanding diet and physical activity behaviors and related potential mediators.

These dissertation activities were conducted within the context of a larger, on-going, two-by-two factorial designed National Cancer Institute (NCI) funded educational intervention study, *Mi Vida Saludable* (My Healthy Life), which aims to change diet and physical activity behaviors of Hispanic/ Latina breast cancer survivors. The main study will examine the separate and synergistic effects of a) online education and b) in-class education. The intervention is based upon nutrition education curricula developed by the non-profit organization Cook for Your Life, which develops recipes and cooking education for cancer patients and survivors in New York City and a previous intervention conducted by this research group, that targeted fruit, vegetable, and dietary fat intake only. The on-going larger study, *Mi Vida Saludable*, involves cohorts of 30-40 Hispanic/ Latina breast cancer survivors who go through the intervention arms, at intervals of every 4-8 months, depending on recruitment. As of April 2018, two of the five planned cohorts have completed the study, and four of the five cohorts have been randomized.

The purpose of the initial comprehensive review of the literature was to inform the development of this *Mi Vida Saludable* educational intervention. Three areas relevant to the intervention were reviewed. The first area was the varying dietary and physical activity guidelines, both for cancer survivors, and also for common simultaneously occurring lifestyle-related diseases such as heart disease and diabetes. Similarities and differences were examined, and the resulting recommendations were used in the intervention development. The second area of review consisted of dietary and physical activity interventions that specifically targeted breast cancer survivors. Commonalities of successful interventions included the use of Social Cognitive

Theory and the Stages of Change construct of the Transtheoretical Model. Finally, the text message literature was reviewed as it pertains to weight management, dietary, and physical activity behaviors, specifically among Hispanic/ Latina populations. Findings indicated that text message interventions were more successful if they decreased in frequency over time, included specific educational advice, and had the ability for two-way communication. The findings from these literature reviews were used to develop the *Mi Vida Saludable* intervention.

(1). The methodological study involved the development of the content of the *Mi Vida Saludable* group education and electronic ("e-")-communication programs. These programs were developed using a systematic stepwise theory-based, behaviorally-focused process, the Nutrition Education DESIGN Procedure. Briefly, DESIGN stands for: 1. ***D***ecide behaviors; 2. ***E***xplore determinants or potential mediators of change; 3. ***S***elect theory; 4. ***I***ndicate objectives; 5. ***G***enerate plans; and 6. ***N***ail down evaluation. DESIGN was applied to help assure the curricula a) enhance motivation and b) facilitate action to change the following behaviors: 1) increase fruit and vegetable intake, specifically focused on non-starchy varieties, 2) decrease dietary fat intake operationalized as less fatty meats, decreased fat added during cooking, and smaller portions of cheese, 3) decrease added sugar intake operationalized as fewer sugar sweetened beverages and less added sugar in processed food and cooking, and 4) increase daily moderate-to-vigorous physical activity. The behavior-change theory applied was the Social Cognitive Theory. The resulting group education program consisted of 4 lessons, 4 hours each in length. Each lesson included a hands-on cooking component and facilitator-led nutrition education and discussion. Two of the four lessons included field trips to the local grocery store and farmers' market. The resulting e-communication program included 11-months of weekly text messages, biweekly emailed newsletters, and ongoing website access. The content of the online curriculum was

developed after the classroom curriculum and mirrored the classroom curriculum so that mode of education would be the key variable tested.

(2). A survey instrument was developed to assess two key psychosocial potential mediators of behavior change from Social Cognitive Theory, *preferences* and *self-efficacy*, separately for each targeted behavior. This survey was tested for validity and reliability. Expert panel review assessed scale validity by Content and Face Validity. Participants from the target population assessed scale validity and reliability by 1) cognitive interviewing, 2) convergent validity, 3) internal consistency reliability, and 4) test-retest reliability. Content and face validity, and cognitive interviews successfully improved the questionnaire before quantitative analysis. Modifications from content and face validity included the addition of pictures of fruits and vegetables and the addition of examples of different food types high in fat and added sugar. Results from the cognitive interviews indicated primarily that changes should be made in the questionnaire to examples of foods with and without dietary fat and added sugar. Study findings revealed that Cronbach alpha values were sufficient for all Preferences and Self-efficacy scales except for Preferences for Added Sugar Intake. Study findings also revealed that item-total correlations were sufficient for all reduced Preferences and Self-efficacy scales, and that ICC values were sufficient for all Preferences and Self-efficacy reduced scales except for Preferences for Dietary Fat Intake.

(3). Psychosocial potential mediators and measures of quality of life were examined in a cross sectional study of *Mi Vida Saludable* participants as they relate to women's diet and physical activity behaviors at study entry. Outcome variables included diet, specifically servings of fruits and vegetables (both total and varieties specifically targeted by the intervention), percent dietary fat and added sugar, as well and average minutes of physical activity per week. Our study

found that, among Hispanic/ Latina breast cancer survivors, decreased self-efficacy to choose lower sugar foods, increased locus of control of powerful others, and increased stress are related to increased added sugar intake. We also found that increased preferences for foods low in fat are related to decreased fat intake. Finally, we found higher mental health-related quality of life scores are related to increased fruit and vegetable intake, decreased fat intake, and increased physical activity.

The results from these three studies will be used to understand behavioral outcomes of the *Mi Vida Saludable* study, as well as develop future interventions with this and other populations. Advancing our understanding of potential mediators and psychological variables can improve the development and success of interventions, especially among understudied populations such as Hispanic/ Latina breast cancer survivors.

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## ACKNOWLEDGEMENTS

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## DEDICATION

*For cancer survivors.*

# CHAPTER 1: INTRODUCTION AND BACKGROUND

## 1.1 INTRODUCTION

Breast cancer, the second most prevalent cancer in the US, negatively affects Hispanic/ Latina cancer survivors more than non-Hispanic white women. Compared to non-Hispanic white women, Hispanic breast cancer survivors have higher rates of breast cancer recurrence as well as poorer survival, adjusted for age and stage at diagnosis (American Cancer Society, 2015). Diet and physical activity behaviors may decrease risk of breast cancer recurrence as well as improve longevity by decreasing risk for other common chronic diseases such as heart disease and diabetes (World Cancer Research Fund and American Institute for Cancer Research, 2007).

Lifestyle guidelines for cancer survivors recommend engaging in 150 minutes of moderate-to-vigorous physical activity each week and eating a diet high in fruits and vegetables and low in energy-dense foods, i.e. foods high in fat and added sugar (World Cancer Research Fund and American Institute for Cancer Research, 2007). However, most cancer survivors are not currently following these guidelines, and there are limited data supporting how cancer survivors, particularly underserved populations such as Hispanic/ Latina breast cancer survivors, can achieve sustained dietary and activity changes (Blanchard, Courneya, & Stein, 2008; Coups & Ostroff, 2005; Inoue-Choi, Robien, & Lazovich, 2013; Kimmons, Gillespie, & Michels Blanck, 2009).

### 1.1.1 Study Context: Overview of the Mi Vida Saludable (My Healthy Life) Study

A randomized controlled trial, *Mi Vida Saludable* "My Healthy Life" NIH R01 CA186080-01A1, is currently being conducted to determine the effect of a theory-based behavioral intervention on changes in physical activity, fruit and vegetable intake, and intake of

high-fat and high-sugar foods among female Hispanic breast cancer survivors. *Mi Vida Saludable* is an extension of the prior classroom-based curriculum *¡Cocinar Para Su Salud!* (Cook for Your Health!) (Aycinena et al., 2016). *¡Cocinar Para Su Salud!* was a nine-session curriculum designed to increase fruit and vegetable intake and decrease fat intake among Hispanic/ Latina breast cancer survivors (Aycinena et al., 2016). Researchers found the intervention to be highly successful at increasing fruit and vegetable intake by two servings after one year (Aycinena et al., 2016; Greenlee et al., 2015).

*Mi Vida Saludable* is in the process of recruiting 200 female Spanish-speaking Hispanic/ Latina breast cancer survivors to participate in a 12-month randomized controlled trial. The study is a 2x2 factorial design; participants are randomized to one of four groups: 1) one month (4 sessions, 4 hours each) of classroom-based education, 2) 11 months of electronic-based education, 3) classroom-based education *and* electronic-based education, or 4) no additional education (control). All participants meet with a lay health educator for 15 minutes to receive written materials on diet and physical activity recommendations for breast cancer survivors during baseline visits. Both education components of *Mi Vida Saludable* are behaviorally focused and based in Social Cognitive Theory. Clinic visits, blood collection and dietary assessments occur at baseline, six months, and 12 months.

The Primary Aim of *Mi Vida Saludable* is to determine the separate and synergistic effects of the *Mi Vida Saludable* intervention components among Hispanic/ Latina breast cancer survivors as assessed by change from baseline to 12 months, in 1) daily servings of fruits/vegetables and 2) total daily energy density. Secondary Aims are to examine effects of the intervention on physical activity weight loss, and potential mediators of dietary and physical activity change. Study results will determine the most effective and most cost effective ways to

deliver this type of intervention among Spanish-speaking Hispanic/ Latina breast cancer survivors.

### 1.1.2 Overview of This Dissertation

This dissertation focuses on the theoretical development of the program and baseline behaviors and psychosocial characteristics of participants. This dissertation consists of reviews of the educational literature on diet and physical activity studies among breast cancer survivors, and three studies: (1) a methodological description on the development of a theory-based, behaviorally focused intervention with classroom and online education curricula, (2) an empirical validation study of a survey instrument, and (3) a cross sectional study of women's diet and physical activity behaviors and theory-based determinants. This dissertation provides a better understanding of which modes to intervene with racial/ ethnic minority, Hispanic/ Latina populations to improve diet and activity behaviors.

## 1.2 Background and Rationale of the Study

### 1.2.1 Breast Cancer in the US and Health Disparities Among Hispanic Women

Cancer diagnoses among Americans are decreasing (U.S. Department of Health & Human Services, 2015), and incidence rates among women specifically have also decreased significantly from 1990 (U.S. Department of Health & Human Services, 2015). However, breast cancer incidence rates are the highest of all cancer diagnoses (for both men and women); in 2015, nearly 232,000 women were diagnosed with breast cancer, accounting for 14% of new cancer cases in the US (Howlader et al., 2015). Cancer stage, primarily referring to whether it is *localized*, i.e. found in one part of the body, or *regional/ distant*, i.e. has spread to a different

part(s) of the body, at diagnosis strongly determines treatment options and the length of survival (Howlader et al., 2016). Almost two-thirds, 61.1%, of females with breast cancer are diagnosed at the local stage, which is associated with better survival (Howlader et al., 2015).

While female breast cancer is the fourth leading cause of cancer death among all Americans, survival is favorable. More women are living with cancer compared to 15 years ago, likely due to improved detection and treatment procedures (Alfano, Molfino, & Muscaritoli, 2013; U.S. Department of Health & Human Services, 2015). Specifically, 6.5% of women 18 years of age and older reported living with a cancer diagnosis in 2012–2013, compared to 5.8% in 1997–1998 (U.S. Department of Health & Human Services, 2015). Further, five years post diagnosis, the number of women living with breast cancer is second only to melanoma of the skin (U.S. Department of Health & Human Services, 2015). Women diagnosed at earlier ages, and who are diagnosed at earlier stages of breast cancer, are less likely to die of the disease and more likely to survive five years post diagnosis (Howlader et al., 2015). In addition, the five year survival for localized female breast cancer is 98.6%, and death rates for female breast cancer in general have been falling on average 1.9% each year from 2003–2012 (Howlader et al., 2015).

The Latino/ Hispanic population is the largest racial/ ethnic minority group in the United States, compromising 17.4% of the population as of 2014 (Ogden, Carroll, Fryar, & Flegal, 2015; U.S. Census Bureau, 2015). Breast cancer is the most commonly diagnosed cancer among Latinas, and 1 in 10 Latinas will develop breast cancer in her lifetime (American Cancer Society, 2012; U.S. Census Bureau, 2012). Compared to non-Hispanics, Hispanics are at greater risk of health disparities (Yracheta et al., 2015), in fact Hispanic populations are at greater risk of cancer recurrence compared to non-Hispanic Whites which may be due to poor access to medical services (Adams, Barnes, & Vickerie, 2008), high rates of diabetes and obesity (Hedley et al.,

2004), and lower rates of physical activity (Schoenborn & Heyman, 2009). In addition, while Hispanic women may have lower incidence of breast cancer than non-Hispanic whites, they also are 20% more likely to die of breast cancer than non-Hispanic whites controlling for age and stage at diagnosis (Ooi, Martinez, & Li, 2011). Further, many Hispanics, particularly in US urban areas where they are increasingly concentrated, face profound barriers to behavior change, including cultural norms and dietary practices (particularly among Caribbean Hispanics compared to Mexican groups), low health literacy and language barriers, poverty, and lack of access to healthful foods (Daviglus et al., 2012).

### 1.2.2 Lifestyle Recommendations for Healthy Populations and for Prevention of Cancer Recurrence

Some lifestyle behaviors, including poor dietary choices and physical inactivity, are risk factors for cancer development and recurrence primarily of the breast, colon, rectum, endometrium, esophagus, kidney, pancreas, and gallbladder (American Cancer Society, 2015). However, according to the American Institute for Cancer Research (AICR), more than 30% of breast cancer recurrences and deaths are preventable by post-diagnosis lifestyle modifications (Barnes, Steindork, Hein, Flesch-Janys, & Chang-Claude, 2011; Sprague, Trentham-Dietz, Egan, & al., 2008). Similar behaviors are risk factors for other chronic illnesses such as type-2 diabetes, stroke, and heart disease (U.S. Department of Health & Human Services, 2009), and improving upon them may not only decrease disease occurrence, but may also increase longevity and quality of life (Adriaanse, Drewes, van der Heide, Struijs, & Baan, 2016; Centers for Disease Control & Prevention, 2016; Inoue-Choi et al., 2013).

National and international organizations produce evidence-based lifestyle recommendations based on the current literature for the prevention of cancer recurrence and for the prevention of other chronic diseases including heart disease, diabetes, and stroke. These guidelines are all very similar, but contain slight differences. As low-income populations receive nutrition and physical education from a variety of programs and sources, it is important to understand these similarities and differences in order to accurately relay information. Further, as many chronic diseases are comorbidities of each other, understanding the minimal or overarching similarities across guidelines could be useful for target groups.

However, studies suggest that individuals diagnosed with breast cancer often decrease their physical activity levels and consume poor-quality diets to "self-nourish" from the stress, unpleasant nature, and financial costs of cancer treatment (Alfano et al., 2013). Inaccurate, albeit well-meaning information sources, such as friends, family, and other patients and survivors, may also negatively impact health behaviors (Alfano et al., 2013). This complex phenomenon is concerning especially since the prevalence of breast cancer survivors is growing (U.S. Department of Health & Human Services, 2015). In fact, women diagnosed with breast cancer are more likely to die of a non-communicable chronic illness such as cardiovascular disease than breast cancer itself, so focusing on common risk factors before, during, and after treatment may be beneficial (American Cancer Society, 2015; Weaver et al., 2013).

Descriptions of the national and international guidelines to promote health behaviors are summarized in Tables 1.1 and 1.2 and are examined in detail below. General health promotion guidelines, produced at the federal and international levels, are used to assist health professionals and develop health policies and programs. This review will focus only on recommendations for adults, as the *Mi Vida Saludable* program includes women ≥21 years of age. Guidelines reviewed

here focus only on physical activity, food groups, and nutrients that provide calories (i.e. excluding sodium); they do not include information on recommendations for calorie restriction, weight management, or medications.

**Table 1.1. Select Energy Balance Diet and Physical Activity Recommendations for Prevention of Cancer Recurrence**

| | *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective, 2007;* World Cancer Research Fund and American Institute for Cancer Research; 2007 | *AICR's Guidelines for Cancer Survivors;* American Institute for Cancer Research*;* 2015 | *American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Survivors*; American Cancer Society; 2012 |
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| **Physical Activity Recommendations** | 1. Be physically active as part of everyday life<br>2. Be moderately physically active, equivalent to brisk walking, for at least 30 minutes every day<br>3. As fitness improves, aim for 60 minutes or more of moderate, or for 30 minutes or more of vigorous, physical activity every day<br>4. Limit sedentary habits such as watching television | 1. Be physically active for at least 30 minutes every day. | 1. Avoid inactivity and return to normal daily activities as soon as possible following diagnosis.<br>2. Aim to exercise at least 150 minutes per week.<br>3. Include strength-training exercises at least 2 days per week. |
| **Plant Foods Recommendations** | 1. Eat mostly foods of plant origin<br>a. Eat at least five portions/ servings (at least 400 g or 14 oz) of a variety of non-starchy vegetables and of fruits every day<br>b. Eat relatively unprocessed cereals (grains) and/or pulses (legumes) with every meal<br>c. Limit refined starchy foods<br>d. People who consume starchy roots or tubers as stables also to ensure intake of sufficient non-starchy vegetables, fruits, and pulses (legumes) | 1. Eat more of a variety of vegetables, fruits, whole grains and legumes such as beans. | 1. Achieve a dietary pattern that is high in vegetables, fruits, and whole grains.<br>a. Eat at least 2.5 cups of vegetables and fruits each day.<br>b. Choose whole grains instead of refined grain products. |
| **Dietary Fat & Added Sugar Recommendations** | 1. Limit intake of red meat and avoid processed meat. People who eat red meat [should] consume less than 500 g (18 oz) a week, very little if any [should] be processed.<br>2. Limit consumption of energy-dense foods. Consume fast foods sparingly, if at all.<br>3. Avoid sugary drinks. | 1. Limit consumption of red meats (such as beef, pork and lamb) and avoid processed meats.<br>2. Avoid sugary drinks, and limit consumption of energy-dense foods (particularly processed foods high in added sugar, low in fiber or high in fat). | 1. Limit consumption of processed meat and red meat. |

## Table 1.2. Select Energy Balance Diet and Physical Activity Recommendations for Healthy Populations

| | *Healthy Diet*; World Health Organization; 2015<br><br>*Global Recommendations on Physical Activity for Health*; World Health Organization; 2010 | *Dietary Guidelines for Americans 2015-2020*; US Department of Agriculture & US Department of Health and Human Services; 2015<br><br>*2008 Physical Activity Guidelines;* US Department of Health and Human Services*;* 2008 | *2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk;* American Heart Association*;* 2013 | *American Diabetes Association Standards of Medical Care in Diabetes – 2017*; American Diabetes Association; 2017 |
|---|---|---|---|---|
| **Physical Activity Recommendations** | 1. Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.<br>a. Aerobic activity should be performed in bouts of at least 10 minutes duration.<br>b. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.<br>2. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week. | 1. All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.<br>2. For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity.<br>a. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.<br>b. For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes (5 hours) a week of moderate intensity, or 150 minutes a week of vigorous intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity. Additional health benefits are gained by engaging in physical activity beyond this amount.<br>3. Adults should also do muscle-strengthening activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits. | 1. Aim for at least 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity – or an equal combination of both – each week. | 1. Patients with pre-diabetes should increase their moderate-intensity physical activity (such as brisk walking) to at least 150 minutes/ week. |

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| **Plant Foods Recommendations** | 1. | A healthy diet contains fruits, vegetables, legumes (e.g. lentils, beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat, brown rice).<br>a. A healthy diet contains at least 400 grams (5 portions) of fruits and vegetables a day. Potatoes, sweet potatoes, cassava and other starchy roots are not classified as fruits or vegetables. | 1.<br><br><br><br><br><br><br><br>2.<br><br><br>3. | A healthy eating pattern includes a variety of vegetables from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other<br>A healthy eating pattern includes fruits, especially whole fruits<br>A healthy eating pattern includes grains, at least half of which are whole grains | 1.<br><br><br><br><br><br><br><br><br><br>2. | Eat a variety of fresh, frozen and canned vegetables and fruits without high-calorie sauces or added salt and sugars. Replace high-calorie foods with fruits and vegetables.<br>Choose fiber-rich whole grains for most grain servings. | 1.<br><br><br><br><br>2. | Data suggest that whole grains may help to prevent type 2 diabetes.<br>Higher intakes of […] berries [is] associated with reduced diabetes risk. |
| **Dietary Fat & Added Sugar Recommendations** | 1.<br><br><br><br><br><br><br><br><br>

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| | 6. | total calories.<br>Cut back on beverages and foods with added sugars. |

Note: All guidelines not published on a continual basis nor have plans for updated versions except for *Dietary Guidelines for Americans* (2020); *Physical Activity Guidelines for Americans* (2018)*; American Diabetes Association Standards of Medical Care in Diabetes* (2018)

**Recommendations produced for general health promotion and chronic disease prevention including cancer prevention.** Three primary guidelines focus on cancer prevention and survivorship, particularly after treatment, were published by the American Cancer Society (ACS), American Institute for Cancer Research (AICR), and the World Cancer Research Fund (WCRF). See Table 1. In addition to cancer prevention, these guidelines aim to reduce risks of comorbid conditions including metabolic disorders and heart disease (Singla, Kumar, & Bardia, 2012; Weaver et al., 2013; World Cancer Research Fund and American Institute for Cancer Research, 2007). ACS published their recommendations in 2012; their report is intended for health care providers to relay accurate information to their patients. AICR and WCRF jointly published their guidelines in 2007; their first guidelines were published in 1997. AICR and WCRF's recommendations "are recognized as the most authoritative and influential report in its field [and has] become the standard text worldwide for policy-makers […], civil society and health professional organizations, and in teaching and research centers of academic excellence" (World Cancer Research Fund and American Institute for Cancer Research, 2007). AICR published an updated truncated version of the guidelines on their website in 2015.

Table 2 describes recommendations for healthy populations and prevention of obesity, diet, and physical activity related chronic diseases type-2 diabetes and heart disease. The US Department of Health and Human Services (USDHHS) and the US Department of Agriculture (USDA) jointly produce the *Dietary Guidelines for Americans* every five years, the most recent of which was published in 2015 (U.S. Department of Health & Human Services and U.S.

Department of Agriculture, 2016). The *Dietary Guidelines for Americans* was designed to help the general healthy public aged 2 years and older consume a healthful diet (U.S. Department of Health & Human Services and U.S. Department of Agriculture, 2016). The Guidelines also provide recommendations for the prevention of common health-related conditions in the US including cardiovascular disease, type-2 diabetes, cancer (specifically breast and colorectal cancers), and bone health (U.S. Department of Health & Human Services and U.S. Department of Agriculture, 2016). In addition, the USDHHS published the *Physical Activity Guidelines for Americans* in 2008, which "provide[s] science-based guidance to help Americans ages 6 years and older maintain or improve their health through regular physical activity" (U.S. Department of Health & Human Services, 2008). The goal of the *Physical Activity Guidelines* is to complement the *Dietary Guidelines* to promote good health and reduce the risk of chronic diseases for Americans (U.S. Department of Health & Human Services, 2008). While the *Physical Activity Guidelines* are not legally obligated to be published on a continual basis, the next set of Guidelines are set to be published in 2018 (U.S. Department of Health & Human Services, 2008).

The World Health Organization publishes various recommendations, but do not routinely publish global nutrition or physical activity guidelines, as developing and developed countries have varying needs. Most recent related health promotion and chronic disease prevention guidelines include the *Healthy Diet Fact Sheet #394* updated in September 2015 which focus on "protect[ing] against malnutrition in all its forms, as well as non-communicable diseases […], including diabetes, heart disease, stroke and cancer" for those of all ages (World Health Organization, 2015). *Global Recommendations on Physical Activity for Health*, developed in

2010, are aimed at those 5 years of age and above, and encourage physical activity primarily as prevention of non-communicable diseases (World Health Organization, 2010).

Primary related comorbidities to breast cancer include heart disease and diabetes. The most relevant American Diabetes Association (ADA) diet and physical activity recommendations, written for health professionals, aim to decrease risk and delay progression towards type 2 diabetes. The *American Diabetes Association Standards of Medical Care in Diabetes – 2017* are published annually (American Diabetes Association, 2017). The American Heart Association (ADA) guidelines, *AHA Guideline on Lifestyle Management to Reduce Cardiovascular Risk 2013*, aim to prevent cardiovascular disease by determining which dietary patterns and levels of physical activity can modify blood pressure and lipids. The primary audience for this report is primary care providers, but supplemental guidelines are published online for lay audiences.

**Comparing diet recommendations.** The following dietary recommendations provide guidance on general food types such as plant-based foods and nutrients such as dietary fat and added sugar from the above mentioned organizations. Food groups are generally targeted in order to impact certain nutrient consumption, e.g. decreasing certain protein foods to decrease dietary fat. Foods containing nutrients to decrease, e.g. fat and sugar, are sometimes referred to as "energy dense foods".

***Plant Foods Recommendations***. All dietary recommendations emphasize consumption of both fruits and vegetables; however, some are more specific than others in terms of portion size, color, variety, and whether or not starchy types are included. WHO and WCRF/ AICR guidelines recommend at least 400 grams or five portions daily of, specifically, non-starchy fruits and vegetables. The American Cancer Society also has specific daily serving size

recommendations, specifying 2.5 cups of all vegetables and fruits. USDA/ USDHHS guidelines recommend a variety of colors of vegetables, including starchy types, and recommending focusing on fruits in their whole forms. Examining different calorie levels within the Dietary Guidelines provides specific recommendations for the number of cups recommended. AHA guidelines specify not only fresh vegetables and fruits, but also those of frozen and canned varieties without "high-calorie sauces or added sugars". ADA guidelines only specify that berries are associated with reduced diabetes risk.

A few guidelines incorporate other plant foods such as grains, especially minimally processed versions, legumes, and nuts. The Dietary Guidelines for Americans recommend a healthy dietary pattern to include grain foods, at least half of which are whole grains (as opposed to refined grains). AHA guidelines recommend choosing "fiber-rich" whole grains for most grain servings. The WCRF/ AICR guidelines encourage unprocessed grains and/ or legumes at every meal, and to limit refined starchy foods. The 2015 AICR guidelines update and the ACS guidelines encourage whole grains and legumes specifically, but do not elaborate further. ADA guidelines specifically state that whole grains may help prevent type 2 diabetes.

***Dietary Fat & Added Sugar Recommendations***. Only a few recommendations include protein and/ or dairy foods specifically. The DGA recommend a healthy eating pattern including a variety of proteins from animal (specifying lean sources) and plant sources as well as fat-free or low-fat dairy milk, yogurt, cheese, and/ or fortified soy beverages. AHA guidelines also recommend lean cuts and types of poultry, fish, and meat and emphasize preparing them with low amounts of fat. They also uniquely recommend fish with omega-3 fatty acids twice per week. WCRF/ AICR advise limiting intake of red meat, or intake less than 500 grams per week of red meat if at all consumed, and avoiding all processed meat. ACS guidelines provide the

same recommendation but do not specify 500 grams. ADA guidelines indicate yogurt and nuts are associated with decrease diabetes risk, and red meat is associated with increased risk.

Most guidelines recommend a diet low in fat or in certain types of fat. WHO guidelines recommend a diet with less than 30% of total energy intake from fat, and emphasize that unsaturated fats are preferable to saturated and trans fats. AHA guidelines corroborate this recommendation, but do not list a recommendation for total percentage of calories for dietary fat. Regarding saturated fat, the DGA specifically recommend less than 10% of total calories; while AHA guidelines recommend less than 5-6%. ADA provides the only guidelines that state that the quality of fats (e.g. focusing on unsaturated fats) is more important than quantity of fat.

The majority of guidelines recommend a diet low in added sugar or do not recommend foods high in added sugar. Both the DGA and WHO guidelines recommend consuming <10% of calories from added or "free" sugars; WHO guidelines specify consuming ideally <5% of calories from free sugars. WCRF/ AICR and ADA guidelines recommend limiting sugary-sweetened beverages specifically, and AHA guidelines recommend "cutting back" on foods and beverages with added sugars.

**Comparing physical activity recommendations.** Most guidelines recommend 30 minutes of moderate to vigorous physical activity; some recommend this amount every day, but most recommend 30 minutes at least five days per week (or 150 minutes per week). WHO and USDHHS guidelines also indicate that 75 minutes of vigorous physical activity is acceptable if preferred, and performing aerobic activity in 10-minute intervals. WHO, USDHHS and AICR guidelines encourage including muscle strengthening exercises two days per week.

**A summary of recommendations.** For the purposes of *Mi Vida Saludable*, recommendations were condensed to encompass the minimum recommendations necessary for

the prevention of breast cancer and common comorbidities heart disease and type-2 diabetes as well as the promotion of good health: 1) Participate in 30 minutes of moderate to vigorous physical activity 5 days per week; 2) Focus on plant-based foods: eat at least 2 ½ cups of fruits and vegetables per day; 3) Limit energy-dense foods including: a) foods high in fat; b) foods high in added sugar (Table 1.3).

**Table 1.3. Condensed Energy Balance Diet and Physical Activity Recommendations for Healthy Populations and for Prevention of Cancer Recurrence**

| Physical Activity Recommendations | Diet Recommendations |
|---|---|
| 1. Participate in 30 minutes of moderate to vigorous physical activity 5 days per week | 1. Focus on plant-based foods – eat at least 2 ½ cups of fruits and vegetables per day<br>2. Limit energy-dense foods including: a) foods high in fat; b) foods high in added sugar |

There are clearly many health promoting lifestyle recommendations, which have much in common and are promoted through each organization in various educational manners. Data suggest that AICR/ WCRF and ACS guidelines can be effective in improving the risk of breast cancer recurrence, overall survival, and quality of life (Inoue-Choi et al., 2013). Despite these recommendations, recent studies show that, on average, US cancer survivors including breast cancer survivors, behave similarly to most Americans, with a minority consuming the recommended five daily servings of fruits and vegetables and <30% of energy from fat and few meet physical activity guidelines (Blanchard et al., 2008; Coups & Ostroff, 2005; Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000; Inoue-Choi et al., 2013; Kimmons et al., 2009; McBride, Clipp, Peterson, Lipkus, & Demark-Wahnefried, 2000). Clearly, effectively educating cancer survivors and changing behaviors is a challenge; best practices to relay these guidelines in a variety of patient populations are unknown.

### 1.2.3 Theoretically Based Diet and Physical Activity Education Programs for Breast Cancer Survivors

Educational efforts have the opportunity to improve these behaviors if implemented appropriately. However, educating breast cancer survivors, like most audiences, is difficult since most lack the knowledge and skills needed for behavior change (Sabatino et al., 2007). The current standard of care for cancer survivors is to provide information via written materials and/or a brief session with a clinician or nutritionist, which has been shown to be largely ineffective for sustained behavior change (Contento, 2015; Institute of Medicine of the National Academies, 2005). Focusing on energy balance, namely dietary intake and energy expenditure, may be particularly effective to improve biological, physical, psychological, and economic outcomes among breast cancer survivors.

Behaviorally-focused and theory-based nutrition and physical activity education has been shown to be effective in many populations, including cancer survivors, compared to standard care (Contento, 2015). Behavior change theories provide a conceptual framework or map using psychosocial determinants, which can help design and evaluate intervention curricula (Contento, 2015). This overview will examine outcomes of theory-based dietary and physical activity education interventions among breast cancer survivors, with special attention focused on aspects of interventions that could be particularly helpful, such as electronic methods. PubMed was the primary search engine used, and article reference lists also provided means for study identification.

Studies were included if they met all four of the following attributes: a) randomized control trials using education of any form to change dietary or physical activity behaviors describing outcomes quantitatively, b) explicitly based in an identified psychosocial theory, c)

published between 1997 (the year new lifestyle guidelines for cancer patients and survivors were published) (Cerully, Klein, & McCaul, 2006), and April 2015, when this literature review was conducted, in order to inform the development of the *Mi Vida Saludable* intervention, and d) targeted only female breast cancer survivors who may or may not be receiving hormone therapy but were not receiving chemotherapy, radiation therapy, or scheduled for upcoming surgery. Studies were excluded if they included other types of cancer survivors, e.g. cervical, as other populations may present unique determinants of behavior change. Results of nine eligible and included studies are shown in Table 1.4.

**Table 1.4. Theoretically Based Diet and Physical Activity Education Programs for Breast Cancer Survivors**[1]

| Reference | Behavior Focus | Theory | Aspects of Intervention<br>• Interaction setting<br>• Type<br>• Number of sessions[7]<br>• Control | Participants<br>• Sample size (retention %)<br>• Mean age<br>• Ethnicity<br>• Race[5] | Duration<br>• Intervention<br>• Follow-up[3] | Initial Outcomes[9]<br>• Psycho-social<br>• Dietary<br>• PA<br>• Physical health[4] | Follow-Up Outcomes[10]<br>• Psycho-social<br>• Dietary<br>• PA<br>• Physical health |
|---|---|---|---|---|---|---|---|
| **Hatchett (2012)** | PA | Social Cognitive Theory | • Home<br>• 1)[6] Individual email messages, individual web sessions<br>• 43<br>• Delayed control | • n=85 (87%)[8]<br>• NA[2]<br>• Non-Hispanic, Hispanic<br>• White | • 3 months<br>• NA | • NA<br>• NA<br>• 1) More moderate to vigorous PA days per week<br>• NA | NA |
| **Matthews (2007)** | PA | Social Cognitive Theory | • Home<br>• 1) In-person individual sessions, phone individual sessions<br>• 6<br>• Delayed control | • n=36 (94%)<br>• 57 years<br>• NA<br>• White, Black/ other | • 3 months<br>• NA | • NA<br>• NA<br>• 1) Increased walking hours per week<br>• Not significant | NA |
| **Rogers (2009)** | PA | Social Cognitive Theory | • Clinic, Home<br>• 1) Individual sessions, group sessions<br>• 21<br>• Delayed control | • n=41 (92%)<br>• 53 years<br>• NA<br>• White, other | • 3 months<br>• NA | • 1) Improved social well-being<br>• NA<br>• 1) Increase in total activity expenditure, left handgrip, back leg extensors<br>• 1) More joint stiffness, lower waist-to-hip ratio | NA |
| **Pinto (2009)** | PA | Social Cognitive Theory, Transtheoretical Model | • Home<br>• 1) Individual phone sessions<br>• 12<br>• No intervention | • n=86 (95%)<br>• 53 years<br>• NA<br>• White | • 3 months<br>• NA | • 1) Self-efficacy predicted exercise minutes<br>• NA<br>• 1) More minutes of PA<br>• NA | NA |
| **Pinto (2013)** | PA | Social Cognitive Theory, | • Home, clinic<br>• 1) Individual | • n=192 (84%) | • 3 months<br>• 6 months, 12 | • 1) More participants moved into action/ | • More participants moved into action/ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Transtheoretical Model | phone sessions, individual in-person sessions<br>• 14<br>• 1) 8 individual phone sessions (did not discuss PA) | • 60 years<br>• Non-Hispanic, Hispanic<br>• White, Black | months | maintenance phase from (pre)contemplation phase<br>• NA<br>• 1) Increased daily activity, less physical fatigue, more participants met PA guidelines<br>• 1) Fewer physical limitations | maintenance phase from (pre)contemplation phase (6 & 12 mo.)<br>• NA<br>• 1) Increased physical activity (6 & 12 mo.), less fatigue (6 & 12 mo.), more participants met PA guidelines (6 mo.) |
| **Basen-Engquist (2006)** | PA | Theory of Planned Behavior, Transtheoretical Model | • Clinic, Community center, Home<br>• 1) Group sessions<br>• 21<br>• Mailed PA pamphlets | • n=60 (85%)<br>• 55 years<br>• Non-Hispanic<br>• White, Black | • 6 months<br>• NA | • 1) More participants in action/ maintenance phase than control<br>• NA<br>• 1) Distance in 6-minute walk<br>• 1) Less bodily pain, higher general health scores | NA |
| **Latka (2009)** | PA | Transtheoretical Model | • Community center<br>• 1) Group sessions<br>• 72<br>• Delayed control | • n=75 (70%)<br>• 56 years<br>• NA<br>• White, Black | • 6 months<br>• NA | • 1) More participants moved into action/ maintenance phase from (pre)contemplation phase<br>• NA<br>• 1) More minutes per week physical activity<br>• 1) BMI decreased, smaller waist circumference | NA |
| **Greenlee (2015)** | NTRN | Social Cognitive Theory, Transtheoretical Model | • Community center<br>• 1) Group sessions<br>• 9<br>• Written dietary recommendations | • n=70 (87%)<br>• 57 years<br>• Hispanic<br>• White, Black | • 3 months<br>• 6 months | • NA<br>• 1) Lower intake of total fat, saturated fat, calories. Higher intake of fruits and vegetables.<br>• NA<br>• Non-significant | • NA<br>• 1) Lower total calorie intake. Higher fruit and vegetable intake.<br>• NA<br>• Non-significant |
| **Kim (2011)** | NTRN, PA | Transtheoretical Model | • Home<br>• 1) Individual Phone sessions<br>• 12<br>• NR[2] | • n=45 (80%)<br>• 46 years<br>• NA<br>• Asian | • 2 months<br>• NA | • 1) Both PA and NTRN: More participants moved into action/ maintenance phase from (pre)contemplation phase. Emotional quality of life improved more than control. Decreased depression scores.<br>• 1) Diet quality improved<br>• Not significant<br>• 1) Decrease in fatigue scales compared to control | NA |

Note:
1. Organized by: a) behavior focus (alphabetical), b) theory (alphabetical), and c) reference
2. NR = assessed but not reported in study results, NA = not applicable: not measured or does not apply to this study
3. Follow up: months from baseline
4. Health outcomes include, e.g., BMI, body fat, lean body mass
5. Race/ ethnicity: listed in order from most to least percentage
6. Type: the number is arm number in the intervention
7. Sessions: Must have interaction with study staff. If instructed to do something on own, did not count as a "session"
8. Attrition rate is calculated at final end of the study (end of follow-up if applicable)
9. Significant outcomes compared to controls
10. Significant outcomes compared to controls

**Physical activity theory-based interventions.** Social Cognitive Theory (SCT), which posits that behavior influenced by personal, social, and environmental factors, developed by Dr. Albert Bandura in 1977 (Bandura, 1977), was used to create interventions in three studies (Hatchett, Hallam, & Ford, 2013; Matthews et al., 2007; Rogers et al., 2009). Hatchett et al., Matthews et al., and Rogers et al. each developed three-month long (no follow-up) studies with predominantly White participants. The studies used one intervention arm and one delayed control arm (Hatchett et al., 2013; Matthews et al., 2007; Rogers et al., 2009). All three studies measured and improved physical activity behavior in the intervention group, but in different ways (Hatchett et al., 2013; Matthews et al., 2007; Rogers et al., 2009). While duration as days per week in physical activity increased among intervention participants in the study by Hatchett et al. compared to controls ($p=0.002$), as hours per week compared to controls in the study by Matthews et al. ($p=0.01$), and as total energy expenditure, i.e. duration and intensity, as measured by accelerometer, increased ($p<0.05$) in the study completed by Rogers et al. (Hatchett et al., 2013; Matthews et al., 2007; Rogers et al., 2009).

Improved physical health benefits were only seen in the study by Rogers et al., where participants decreased waist-to-hip ratios compared to controls ($p=0.02$) (Rogers et al., 2009). Participants from the study by Matthews et al. did not improve body mass index or percent body fat (Matthews et al., 2007).

Only Rogers et al. examined changes in constructs from SCT, and saw improved social well-being among intervention participants compared to controls ($p=0.03$). It is interesting to note that while Rogers et al. received the most comprehensive results across types of outcomes, their study was conducted in person rather either solely over the phone, by email, or with a combination of in-person and virtual aspects, as seen with Hatchett et al. and Matthews et al.

(Hatchett et al., 2013; Matthews et al., 2007; Rogers et al., 2009). It is also interesting to note that the number of in-person sessions (21) was greater in the study by Rogers et al. than the number of in-person sessions in other studies (Hatchett et al., 2013; Matthews et al., 2007; Rogers et al., 2009).

Two studies used both SCT and the SOC construct of the Transtheoretical Model (TTM) as the frameworks for their interventions. TTM states that people become more willing to change their behavior or adopt a new behavior as they move through the stages of change construct, which typically includes the following phases: 1) *pre-contemplation*, not intending to change or engage in a behavior, 2) *contemplation*, beginning to think about changing behavior, 3) *preparation*, preparing to change behavior, 4) *action,* actively changing behavior, and 5) *maintenance*, continuing the behavior (DiClemente & Prochaska, 1982). The two studies which incorporated SOC, conducted by Pinto et al. in 2009 and 2013, were both administered for 3 months, targeted to a mostly White, middle aged (52-60 year old average) audience, and utilized individualized phone counseling sessions (Pinto, Papandonatos, & Goldstein, 2013; Pinto, Rabin, & Dunsiger, 2009). Pinto et al.'s 2013 study also used in-person counseling visits at a clinic (Pinto et al., 2013).

Self-efficacy predicted mean minutes of weekly activity among all participants in the 2009 study ($p=0.004$) (Pinto et al., 2009), and stages of change were advanced more often in the intervention group compared to control ($p<0.003$) in the 2013 study (Pinto et al., 2013). Self-efficacy was not measured in the 2013 study and the stages of change construct was not measured in the 2009 study (Pinto et al., 2013; Pinto et al., 2009). While time spent engaged in physical activity increased ($p<0.0001$) in the 2009 study, both time and intensity improved, by engaging in 150 minutes of moderate to vigorous physical activity three days per week ($p<0.05$)

in the 2013 study, as well as physical fatigue scores ($p<0.05$), and physical limitation scores ($p<0.05$) (Pinto et al., 2013). These improvements were sustained at six and 12 months follow up (Pinto et al., 2013). Again, the inclusion of in-person sessions suggests that a more comprehensive variety of outcomes can be attained.

Two six-month trials were conducted by Basen-Engquist et al. and Latka et al., which both used group education sessions and were based in the Transtheoretical Model (Basen-Engquist et al., 2006; Latka, Alvarez-Reeves, Cadmus, & Irwin, 2009). Basen-Engquist et al. also based their intervention in the Theory of Planned Behavior, which posits that behavior change is ultimately contingent on behavioral intention (Ajzen, 2011). Even though the number of group sessions was three times as high in the study by Latka et al. (72 sessions versus 21 sessions), both studies saw advancements in the stages of change construct ($p<0.05$) and improved physical activity outcomes, as distance covered ($p=0.005$) from the study by Basen-Engquist et al. and minutes per week ($p=0.02$) from the study by Latka et al. (Basen-Engquist et al., 2006; Latka et al., 2009).

Both studies as well improved physical health outcomes; participants in the intervention arm of Basen-Engquist et al.'s study improved bodily pain ($p=0.02$) and general health measures ($p=0.006$) and participants in the intervention arm of Latka et al.'s study decreased BMI levels ($p=0.04$) and waist circumferences ($p=0.03$) compared to controls (Basen-Engquist et al., 2006; Latka et al., 2009). However, the lowest attrition rate of any study in this review was seen in that of Latka et al. (70%), which may indicate that the number of sessions, while producing significant and lauded physical health and behavior change outcomes, was overwhelming for participants (Latka et al., 2009).

**Diet and physical activity interventions.** The only dietary intervention, conducted by Greenlee et al., used the group session approach based on both SCT and the stages of change (SOC) construct from TTM among primarily Hispanic women over a three month time period, and included a six-month follow-up (Greenlee et al., 2015). Researchers found that participants in the intervention arm consumed lower values of total fat ($p=0.01$), saturated fat ($p<0.001$), and total calories ($p<0.001$) as well as higher intake of fruits and vegetables ($p=0.05$) at three months (Greenlee et al., 2015). Significant calorie and fruits and vegetables intake differences persisted at six months (Greenlee et al., 2015). In this article, no significant changes in BMI, weight, waist circumference, and waist-to-hip ratio were found (Greenlee et al., 2015).

Kim et al. examined the only combined diet and activity intervention to date. It was based in the SOC construct from TTM and used an individual phone session approach among Asian women for 2 months with no follow-up (Kim et al., 2011). Advancements in stages of change were seen for both activity ($p=0.006$) and diet ($p<0.001$) behaviors as well as improved emotional quality of life ($p=0.004$) and depression ($p=0.035$) scores (Kim et al., 2011). In addition, diet quality ($p=0.005$) and fatigue ($p=0.001$) scales improved compared to controls (Kim et al., 2011).

Using the SOC construct from TTM either in-person or during phone based sessions may improve dietary outcomes, even in the long term as was seen with Greenlee et al.'s results. The larger number of phone sessions over a shorter period of time (in the study by Kim et al., 2011) compared to most other studies in this review may have helped to improve psychosocial constructs for both physical activity and diet.

**Summary**. It seems clear that using theory-based and behaviorally focused interventions can help breast cancer survivors improve diet and physical activity behaviors. More literature is

available for physical activity than diet or combined diet and activity programs; additional research is needed to evaluate theory-based interventions for eating behaviors. Studies suggest that the Stages of Change construct from the Transtheoretical Model and Social Cognitive Theory are used most frequently, and that self-efficacy and advancements in stages of change (i.e. from contemplation to action) should be targeted in future interventions. More frequent interactions (in-person or virtual) and in-person sessions specifically may be beneficial. This phenomenon, highlighting the value to face-to-face interaction, has been seen in other interventions as well (Carpenter, Finley, & Barlow, 2004; Sorensen et al., 2006). High attrition may be an issue for electronic methods, and tactics to reduce dropout rates should be explored. In sum, educational programs can improve psychosocial, dietary, activity, and physical and social health outcomes as well as provide a cost-effective option for breast cancer survivors. However, more research is needed to identify how to use electronic modes of education to extend financial resources. In addition, very few studies in this review targeted racial/ ethnic minority groups; more research is needed to assess interventions focusing on underserved populations.

### 1.2.4 Behavioral Interventions in Weight Management, Diet, and Physical Activity Using Text Messaging

Behavioral interventions targeting obesity and energy-balance (i.e. diet and physical activity) for all populations, including Hispanics, more and more are using aspects of electronic health or "eHealth", i.e. using medical and public health practices supported by various electronic devices such as mobile phones, wearable technology (e.g. Fitbits), and computers (*mHealth: New horizons for health through mobile technologies*, 2011). These behavioral interventions are well timed and follow current technology trends (Hutchesson et al., 2015). For

instance, as of 2016, 95% of all Americans, and 98% of Hispanics specifically, owned any type of cell phone (77% of all Americans, and 75% of Hispanics own smartphones) (Pew Research Center, 2014). Further, the most used function of all cell phones (smartphones included) was to "send or receive text messages" (Pew Research Center, 2014). Hispanics specifically have shown to be in greater support of using text messaging in patient-provider interactions and for sharing health information (Hanson, West, Thackeray, Barnes, & Downey, 2014; Jenssen, Mitra, Shah, Wan, & Grande, 2015). Reasons for the greater use of cell phones are unclear, as minorities are more likely to be concerned with privacy and security of health data (Hung et al., 2013). This finding is surprising, as a lack of security could increase the risk of loss of confidentiality (Schultz, 2012). However, capitalizing on this population's encouragement of text communications is likely beneficial for researchers at this time.

Even though using text messaging as a tool in behavior interventions is a relatively new practice, researchers have conducted various systematic reviews and meta-analyses in the past few years to better understand this body of work. All reviews mentioned in this synthesis have not focused specifically on Hispanic populations, emphasizing the need for more research in this area. A summary of possible effective characteristics of text messages to be used by health care providers and nutrition and physical activity researchers is summarized in Table 1.5. This table was created to inform the development of the *Mi Vida Saludable* intervention.

**Table 1.5. Possibly Effective Components for Text Message Interventions by Health Behavior**

| | |
|---|---|
| Physical activity | Inclusion of environmental aspects (e.g., identification of local walking paths) |
| | Tailoring or personalization (e.g., targeting stages of change from the TTM) |
| Weight management | Ability for two-way communication e.g. participants responding to interventionists' questions or participants initiating conversation with the interventionists |

| | |
|---|---|
| General health promotion behaviors | Decreasing frequency over time compared to a fixed frequency (i.e., the same number of texts in a short period of time replicated for the length of the study) |
| | Tailoring and personalization |
| | Provision of feedback |
| | Inclusion of (sometimes short) specific strategies to accomplish various behavior changes (e.g. cueing or reminding of certain behaviors, "challenge messages") |

One "umbrella" review, a systematic review of fifteen meta-analyses and systematic reviews, examined text messaging interventions for adults (demographic descriptions of participants not reported) focusing on health improvement behaviors such as diabetes self-management, weight loss, physical activity, where text messaging was used alone (in about half of the studies) or with other intervention strategies (Hall, Cole-Lewis, & Bernhardt, 2015). Most interventions lasted three to six months, but spanned nine days to two years (Hall et al., 2015). In addition, most interventions messaged participants at least once daily, utilized two-way communication, and used tailoring or personalization (Hall et al., 2015). Researchers found the majority of the work to be effective for weight loss and physical activity outcomes (Hall et al., 2015). In addition, meta-analyses within this review found that receivers of interventions with text messaging had seven times greater weight loss compared to control participants who did not receive text messages or interventions that included text messaging (Hall et al., 2015). The next few sections focus on reviews of text message interventions that aim to improve specific weight management behaviors or examine specific phrasing mechanisms used to change health behaviors.

**Physical activity**. Other reviews and meta-analyses have examined energy-balance related behaviors, although most have focused on solely physical activity, as opposed to diet. One meta-analysis reviewed 19 randomized controlled trials that used text messaging for health

promotion, and found the studies to be overall significantly influential on health behaviors ($d=0.329$; $p<0.001$) (Head, Noar, Iannarino, & Grant Harrington, 2013). Further, researchers found physical activity interventions to be more successful than interventions focused on other health behaviors (Head et al., 2013). Several variables significantly moderated the effects of all reviewed interventions, including tailoring or personalizing text messages and decreasing frequency of text messages over time (e.g. decreasing the number of text messages to 50% of initial text messages sent in the second half or last third of an intervention) (Head et al., 2013).

Another recent (2014) review examined seven studies, which focused on using text messaging to help motivate increased physical activity in adults older than 55 years (Ostrander, Thompson, & Demiris, 2014). Participants in these reviews were mostly White (Ostrander et al., 2014). Findings from this review revealed that most interventions improved physical activity outcomes up to one year after their commencement, and interventions that seemed to improve or strengthen results included environmental aspects (e.g. identification of local walking paths) and/or personalization of texts, targeting participants' stages of change from the TTM (DiClemente et al., 1991; Ostrander et al., 2014).

Further, one systematic review examined the effectiveness of mobile interventions for behaviors related to cardiovascular disease management, including energy-balance behaviors (Pfaeffli Dale, Dobson, Whittaker, & Maddison, 2015). This review included seven experimental or quasi-experimental studies, two of which aimed to increase physical activity behaviors (Antypas & Wangberg, 2014; Maddison et al., 2015). The first of these two studies, conducted by Maddison et al. in 2015, was a single-blinded randomized controlled trial targeting mostly New Zealand European (78%) adults (n=171) with a history of ischemic heart disease (Maddison et al., 2015). Participants were required to be at stable conditions in order to participate in the

study (Maddison et al., 2015). The intervention aimed to improve exercise capacity and physical activity behaviors over six months, and consisted of personalized, automated text messages and access to a secure website (Maddison et al., 2015). Although peak oxygen uptake, their measure of exercise capacity, did not improve in the intervention group, leisure time physical activity improved more than controls (383.2 minutes/week vs. 273.0 minutes/week; p=0.04) (Maddison et al., 2015).

The second physical activity randomized controlled trial intervention in this review, targeted adult participants (n=69; mean age 58 years; race/ ethnicity not reported) in a cardiac rehabilitation program (Antypas & Wangberg, 2014). Participants were randomized into two groups receiving automated text messages and website access that was either tailored or non-tailored (Antypas & Wangberg, 2014). At three months after discharge, the tailored intervention group had a significantly higher median level of total physical activity than the control group measured by the International Physical Activity Questionnaire (5613.0 METS minutes per week v. 1356.0; p=0.02) (Antypas & Wangberg, 2014).

**Weight management**. Some reviews have focused on using text messaging for weight management purposes. One systematic review and meta-analysis examined 14 studies of mostly overweight women, where interventions lasted between one and 24 months, and text messages were distributed as often as daily or as infrequently as every two weeks (Siopis, Chey, & Allman-Farinelli, 2015). Characteristics of text messages in these studies, while not analyzed for moderating or mediating effects, included reinforcements of the target behavior, tailored feedback responses to participants, the ability to send "open" (i.e. unprompted) text messages to interventionists, and the ability to report self-monitoring data such as food intake, physical activity, or weight reporting (Siopis et al., 2015). The weighted mean change in body weight was

significantly greater among intervention participants than controls [-2.56 kg (95% CI: -3.46, -1.65) vs. -0.37 kg (95% CI: -1.22, 0.48)] (Siopis et al., 2015).

**General messaging and message phrasing**. Another systematic review examined the effects of *periodic* (i.e., ranging from multiple times per day, once per day, several days per week, once per week, once per month, bi-monthly, and once per year) *messaging* (i.e., text messaging, print communications, email, telephone, and newspaper articles) across health behaviors, such as diabetes management, diet, and physical activity in 55 studies (De Leon, Fuentes, & Cohen, 2014). Researchers found that most interventions used the TTM, SCT, and goal setting theories as guides in developing their messages (De Leon et al., 2014). Rationales for timing of message dispersion were rarely provided, but messages tended to be sent during the work week and at times perceived by researchers to be of high risk of stimulating negative behaviors (De Leon et al., 2014). Behavioral successes of interventions were achieved by the inclusion of specific strategies to accomplish various behavior changes in text messages, and the ability of the interventionists to provide feedback via text messaging (De Leon et al., 2014).

Finally, some reviews have examined differences between phrasing messages as "gains" (i.e., the benefits of adopting a behavior) or "losses" (i.e., the costs of not adopting a recommendation). One meta-analysis found that, of 89 studies, gain-framed messages were more likely to encourage preventative behaviors ($p=0.002$) than loss-framed messages, particularly for behaviors such as physical activity (Gallagher & Updegraff, 2012). It is possible that positive messages compared to loss-framed message may bolster attitudes, encouragement, and self-efficacy (Gallagher & Updegraff, 2012). Another review found that both gain and loss-framed messages can be effective, but researchers need to account for individual participants' involvement in the health issue and certainty of the outcome, among other factors (Wansink &

Pope, 2015). As seen in previous studies within this review, being able to tailor interventions may be more efficient than sending the same message to all participants in a study (Antypas & Wangberg, 2014; Hall et al., 2015; Head et al., 2013; Siopis et al., 2015).

**Behavioral interventions and observational studies targeting Hispanic populations.** A limited number of behavioral interventions and observational studies regarding use of text messaging have targeted typically low-income Hispanic populations, discussed below (Collins et al., 2014; Kolodziejczyk et al., 2013; Stockwell et al., 2014). Results suggest that Hispanic populations are receptive to receiving text messaging from health care providers or health care researchers that target improving health and energy-balance behaviors (Collins et al., 2014; Kolodziejczyk et al., 2013; Stockwell et al., 2014).

One study encouraged Latino publicly insured households (n=161) in New York City to respond to twice weekly text messages inquiring whether anyone in the home was experiencing symptoms of acute respiratory infections or influenza-like illness and had a 73% response rate (Stockwell et al., 2014). Another pilot intervention trial without a control group encouraged Latino adults (n=82) in Kansas to increase physical activity in a six-week trial of tailored text messages based on the TTM (Collins et al., 2014; DiClemente et al., 1991). The intervention successfully moved 91% of participants from earlier (e.g. contemplation) phases to later (e.g. action and maintenance) stages (Collins et al., 2014).

Another intervention targeted weight loss in both Spanish- (45%) and English-speaking overweight or obese adults (n=20) in San Diego, California with three to five text messages sent daily from an automatic server for eight weeks (Kolodziejczyk et al., 2013). Many texts were interactive (i.e., requested a response from the participants) and participants responded to 88% of those message types (Kolodziejczyk et al., 2013). The intervention successfully decreased body

weight (-1.85 kg; p=0.004), and there were no differences in weight by language preference (Kolodziejczyk et al., 2013). A few observational studies have also shown that Hispanic women desire messages that cue specific behaviors (Burner, Menchine, Kubicek, Robles, & Arora, 2014), "challenge" women to perform behaviors, are personalized, and short and specific (Ahlers-Schmidt et al., 2013).

**Conclusions.** In sum, using text messages for Hispanic populations seems like a viable option to improve energy-balance behaviors, especially when targeting physical activity and weight management. Hispanics should specifically be targeted for this behavior intervention approach because the majority of this population owns cells phones, most support using text messaging regarding medical information, interventions using text messages for weight management and energy balance behaviors have been largely effective, and interventions targeting Hispanics specifically have shown to advance determinants of behavior change and decrease body weight. Although the body of literature is growing, reviews and studies call for more research to inform which characteristics of text message interventions are most effective for various populations including Hispanics and other minorities (Hall et al., 2015), as well as which doses, durations, and frequencies of message distribution are most effective (Pfaeffli Dale et al., 2015). More complex methods sections of papers or methods articles such as formative and process evaluations can help inform future studies (Fitts Willoughby & Furberg, 2015).

## 1.3 PURPOSE

The purpose of part one of this dissertation is to develop the *Mi Vida Saludable* in-class and online curricula to test in the subsequent trial. The classroom-based curriculum is comprised

of 4 sequential, 4-hour lessons developed for Hispanic/ Latina breast cancer survivors. The curriculum is based on Social Cognitive Theory and the Stages of Change construct of the Transtheoretical Model, and focuses on four key behaviors: 1) increase fruit and vegetable intake; 2) decrease dietary fat intake; 3) decrease added sugar intake; and 4) increase daily physical activity.

This dissertation also develops and validates a psychosocial instrument to assess (at a future time) whether the curricula change potential mediators of behavior change from Social Cognitive Theory, and uses data collected via this instrument to better understand baseline diet and physical activity behaviors of study participants so as to inform future study design.

## 1.4 STATEMENT OF RESEARCH AIMS

### 1.4.1 Chapter 2, Paper 1: Development of a Diet and Physical Activity Intervention for Latina Breast Cancer Survivors using the 6-Step DESIGN Process

Research aim: To develop a theory-based, behaviorally-focused classroom-based curriculum and electronic education program *Mi Vida Saludable* (My Healthy Life), using Contento's 6-step DESIGN process targeting urban Latina breast cancer survivors.

### 1.4.2 Chapter 3, Paper 2: Development and Validation of a Questionnaire to Assess Psychosocial Determinants of Physical Activity, and Fruit, Vegetable, Dietary Fat, and Added Sugar Intake Among Latina Breast Cancer Survivors

Research aim: To validate and test for reliability of the potential mediator questionnaire, which measures the potential mediators *self-efficacy* and *preferences* among urban Latina breast cancer survivors participating in the *Mi Vida Saludable* (My Healthy Life) study.

### 1.4.3 Chapter 4, Paper 3: Dietary and Physical Activity Patterns and Related Psychosocial Factors Among Latina Breast Cancer Survivors: Preliminary Baseline Results of the Mi Vida Saludable Study

Research aim: To examine diet and physical activity patterns and related associations of potential psychosocial mediators preferences and self-efficacy with these patterns among the first three cohorts of urban Hispanic/ Latina breast cancer survivors participating in the *Mi Vida Saludable* (My Healthy Life) study.

## 1.5 SIGNIFICANCE

There are three main approaches to nutrition education: 1) disseminating information solely, 2) motivating and facilitating behavior change, and 3) focusing on environmental changes (Contento, 2015). Much evidence suggests that dissemination of information alone is insufficient. Nevertheless, current practice with cancer survivors is to offer a brief consultation or to provide a hard copy pamphlet of nutrition education (Institute of Medicine of the National Academies, 2005). Registered Dietitians (RDs) are often not available in clinics or only available to very sick patients (Kolasa & Rickett, 2010). We are in need of cost effective solutions to improve morbidity and mortality of breast cancer survivors, particularly among low income and racial/ ethnic minority groups.

Psychosocial theories have not been implemented consistently throughout studies, so it is difficult to say whether using them is truly effective for different populations and to achieve different behavioral goals. Michie et al. 2014 examined associations between extent and type of theory use with intervention effectiveness, and found that theory was not often used extensively in the development of interventions (Prestwich et al., 2014). In addition, more researchers may report using theory for social desirability reasons, but the use of theory had no effect on their intervention (Diep, Chen, Davies, Baranowski, & Baranowski, 2014). Further, many journals require or prefer researchers to use theory, and researchers may therefore try to say they used theory without truly understanding how to implement it. It is also possible that the effect of theory may have been overshadowed or offset by study quality (Diep et al., 2014). Behavioral interventionists should establish and follow intervention design and reporting conventions to provide clarity and permit comparability of studies in reviews and meta-analyses (Diep et al., 2014; Prestwich et al., 2014). Efforts in this study to consistently classify behavioral intervention procedures provide an important component for consistent reporting, using Contento's matrices of determinants, strategies, and example activities (Contento, 2015).

Behavioral and psychosocial data, as they relate to breast cancer and disease risk, are scarce in the general population, but are especially scarce in low income, Hispanic, and breast cancer survivor populations (Contento, 2015). Understanding lifestyle choices and psychological indicators will help researchers and interventionists develop the most effective programs.

## 1.6 SCOPE AND DELIMITATIONS

The population in this study includes Hispanic/ Latina breast cancer survivors that are predominantly Dominican and reside in upper Manhattan and/ or certain neighborhoods of the

Bronx. While the term "urban" and "Latina" or "Hispanic" are used throughout the manuscripts, these terms are more comprehensive than the actual participant population we are drawing from. In addition, while the target population included all Latina breast cancer survivors in New York City, those likely to participate in the study are low income and have relatively low educational attainment, which reduces generalizability. Finally, we are limited to data from the first three cohorts of women going through the *Mi Vida Saluable* study, which are the data collected to date.

## 1.7 DEFINITION OF TERMS

| Term | Definition |
|---|---|
| Nutrition Education | "The learning experience designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being" (Contento, 2015) |
| Mi Vida Saludable | "My Healthy Life"; the name of the intervention for the R01 CA186080 study |

## 1.8 LIST OF ABBREVIATIONS

NR = Not reported

N/A = Not applicable

MiVS = Mi Vida Saludable

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# CHAPTER 2 ARTICLE 1: DEVELOPMENT OF A DIET AND PHYSICAL ACTIVITY INTERVENTION FOR LATINA BREAST CANCER SURVIVORS USING THE 6-STEP DESIGN PROCESS

## 2.1 INTRODUCTION

Breast cancer incidence rates are the highest of all cancer diagnoses among women, and is the most common cancer among Latinas, where it develops in 1 in 10 Latinas (American Cancer Society, 2012; U.S. Census Bureau, 2012). While more women are living with all-types of cancer diagnoses compared to the early 2000s, likely due to improved detection and treatment procedures (Alfano, Molfino, & Muscaritoli, 2013; U.S. Department of Health & Human Services, 2015), Latina populations are at greater risk of cancer recurrence compared to non-Hispanic Whites. This may be due to a number of issues including lack of access to medical services (Adams, Barnes, & Vickerie, 2008), and concurrent high rates of chronic disease such as diabetes and obesity (Hedley et al., 2004; Schoenborn & Heyman, 2009). Importantly, Latinas are 20% more likely to die of breast cancer than non-Hispanic whites (Ooi, Martinez, & Li, 2011).

Lifestyle behaviors including certain dietary choices (e.g. low fruit and vegetable intake, high intake of energy-dense foods), and physical inactivity are established risk factors for breast cancer recurrence (American Cancer Society, 2015). According to the American Institute for Cancer Research (AICR), more than 30% of breast cancer recurrences and deaths are preventable by post-diagnosis lifestyle modifications (Barnes, Steindork, Hein, Flesch-Janys, & Chang-Claude, 2011; Sprague, Trentham-Dietz, Egan, et al., 2008). The AICR and American Cancer

Society (ACS) recommend include eating a diet high in fruits and vegetables, low in fat and added sugar, and increasing physical activity. However, despite these recommendations, most cancer survivors, including breast cancer survivors, do not consume the recommended servings of fruits and vegetables nor a diet low in fat, and few meet physical activity recommendations (Blanchard, Courneya, & Stein, 2008; Coups & Ostroff, 2005; Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000; Inoue-Choi, Robien, & Lazovich, 2013; Kimmons, Gillespie, & Michels Blanck, 2009; McBride, Clipp, Peterson, Lipkus, & Demark-Wahnefried, 2000). Further, women diagnosed with breast cancer are more likely to die of a non-communicable chronic illness such as cardiovascular disease than breast cancer itself, thus focusing on risk factors common to these morbidities before, during, and after treatment may be beneficial (American Cancer Society, 2015; Weaver et al., 2013).

However, simply having recommendations for improved diet and activity behavior is not enough to change behavior, and education is often needed. Approaches to nutrition and physical activity education include: 1) disseminating information, 2) motivating and facilitating behavior change, and 3) focusing on environmental supports for change (Contento, 2015). Evidence suggests that dissemination of information alone is insufficient to change lifestyle behaviors with clinical significance and over the long term (Contento, 2015). Nevertheless, current practice for educating cancer survivors on lifestyle behavior changes is to offer a brief nutrition consultation or to offer educational pamphlets with some nutrition information after a breast cancer diagnosis (Institute of Medicine of the National Academies: Cancer Survivorship Care Planning: Fact Sheet). Nutritional counseling services for breast cancer patients varies across cancer centers and is often not covered by insurance plans (Kolasa & Rickett, 2010). There is a need for cost effective solutions to improve morbidity and mortality of breast cancer survivors. However, few

resources and programs exist for Hispanic/ Latina groups that aim to improve dietary and physical activity choices, particularly in the Spanish language.

Nutrition and physical activity education programs are more effective if they are systematically developed and administered, behaviorally-focused, and theory-based, and culturally tailored (Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2003), and appropriate for a given audience (Baranowski, Cerin, & Baranowski, 2009; Katz, O'Connell, Njike, Yeh, & Nawaz, 2008; Michie & Prestwich, 2010; Wang et al., 2015). Systematic processes need to be applied to developing group education and materials.

There are a number of systematic processes for designing programs in the health education domain. One commonly used process is, the RE-AIM framework, *R*each, *E*fficacy or *E*ffectiveness, *A*doption, *I*mplementation, and *M*aintenance, which aims combine both internal and external validity to translate research into practice (Glasgow, Lichtenstein, & Marcus, 2003; Glasgow, Vogt, & Boles, 1999). Another commonly used model that includes two separate educational and ecological diagnoses, is the PRECEDE-PROCEED framework (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation; Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development), which posits that health behavior is influenced by both individual and environmental factors (Green, 1991; Phillips, Rolley, & Davidson, 2012). These processes are useful for community level interventions, often involving many components. However, they do not provide guidance for actual development of group education or materials.

The DESIGN procedure, on the other hand, focuses on designing both group direct education (e.g., lesson plans) and indirect nutrition education (e.g., handouts, newsletters, recipes) aimed at individual-level behaviors and determinants of change (Contento, 2015).

DESIGN stands for: 1. ***D***ecide behaviors; 2. ***E***xplore determinants or potential mediators of change; 3. ***S***elect theory; 4. ***I***ndicate objectives; 5. ***G***enerate plans; and 6. ***N***ail down evaluation). When using DESIGN there is a flow from using nutrition science to determine the behaviors and content to address, psychosocial theory to determine the potential mediators, educational theory to deciding on the sequencing of activities, and communication theory for how to effectively implement. The DESIGN procedure was selected as the guiding framework to develop a theory-based, behaviorally-focused group-based curriculum and e-communication education program, *Mi Vida Saludable*, targeting Hispanic/ Latina breast cancer survivors.

*Mi Vida Saludable* (My Healthy Life) was initially developed in both English and Spanish, to be tested in a two-by-two factorial trial setting funded by NIH (R01 CA186080-01A1). The main aims of the trial are to test separate and synergistic effects of group or e-communication-based nutrition and physical activity education. The process was overseen by the Columbia University Medical Center and Teachers College Columbia University collaborative research team with expertise in cancer prevention and behavior change and involved community stakeholders. *Mi Vida Saludable* is based on a previously tested intervention entitled *¡Cocinar Para Su Salud!,* which itself was based on education programs developed by the organization Cook For Your Life (CFYL). CFYL provides nutrition education and cooking classes around New York City to groups of English and Spanish speaking cancer survivors. CFYL maintains a website, available in English and Spanish, of hundreds of recipes, and diet- and cooking-related videos and articles serving "people who are touched by cancer" at different stages of cancer treatment and recovery (www.cookforyourlife.org). The *¡Cocinar Para Su Salud!* curriculum consisted of nine weekly sessions that included four nutrition education sessions (2 hours per lesson), two food shopping sessions (2 hours per lesson), and three hands-on cooking lessons (4

hours per lesson), and the intervention, when tested in a randomized controlled trial by our research team, successfully increased fruit and vegetable intake among participating Hispanic/ Latina breast cancer survivors compared to controls (Greenlee et al., 2015).

The Columbia University Medical Center, Teachers College Columbia University, and Cook for Your Life teams developed and implemented the current study, *Mi Vida Saludable,* which is further explained in this manuscript. The purpose of this manuscript is to describe the development of the four-session group education and parallel electronic communication (e-communication)-based program for Hispanic/ Latina breast cancer survivors, *Mi Vida Saludable,* directed at both dietary and physical activity cancer prevention behaviors, using the DESIGN procedure.

## 2.2 METHODS

The steps of DESIGN, used to create our educational program, *Mi Vida Saludable*, are described below.

### 2.2.1 Step 1: Decide *behaviors for education program based on health issues of concern*

In nutrition and physical activity education, a *behavior* is "an observable action" that can be "general, e.g. eating more fruit and vegetables, or specific, e.g. eating more fruit at lunch" (I. R. Contento, 2015). A needs assessment was conducted that reviewed the literature and lifestyle recommendations for cancer survivors, which lead to the following findings (Contento, 2015). Energy balance, i.e. proper intake and expenditure of energy or calories, is key to maintaining weight, thereby likely improving morbidity and mortality from breast cancer and other lifestyle-related chronic diseases (Demark-Wahnefried, Winer, & Rimer, 1993; Lajous, Mozaffarian,

Mozaffarian, Schrag, & Adami, 2011; McTiernan, 2005; Patterson, Cadmus, Emond, & Pierce, 2010). Additionally, AICR and American Cancer Society (ACS) lifestyle recommendations for cancer survivors guide women to choose lower energy dense foods and engage in more physical activity (Kushi et al., 2012; Rock et al., 2012). These guidelines are similar to guidelines for healthy populations, for disease prevention, and for other chronic diseases common among breast cancer survivors including type-2 diabetes and heart disease. A comparison of these guidelines can be found elsewhere (Paul R, Koch P, Contento I, Greenlee H, *in development*). Most behavioral interventions with breast cancer survivors focus on physical activity, showing some success with increased weekly exercise (Hatchett, Hallam, & Ford, 2013; Latka, Alvarez-Reeves, Cadmus, & Irwin, 2009; Matthews et al., 2007; Pinto, Papandonatos, & Goldstein, 2013; Pinto, Rabin, & Dunsiger, 2009). A few studies have also seen improvements in health outcomes such as BMI and waist circumference (Latka et al., 2009). Further, the *¡Cocinar Para Su Salud!* curriculum, on which this study is based, aimed to increase, and succeeded in increasing, fruit and vegetable intake (Greenlee et al., 2015).

As a result of the review of these guidelines and previous work in this area, the final selected behaviors for *Mi Vida Saludable* were to 1) Increase daily minutes of moderate to vigorous physical activity; 2) Increase daily fruit and vegetable intake; 3) Decrease percentage of calories from dietary fat; and 4) Decrease percentage of calories from added sugar. Behaviors were operationalized (Table 2.1) to highlight certain food options to increase and those to decrease based on examining 24-hour recall data of *¡Cocinar Para Su Salud!* Participants (Greenlee et al., 2015), as well as National Health and Nutrition Examination Survey (NHANES) surveillance data of which foods Latina Americans and all Americans consume most frequently (U.S. Deparment of Health & Human Services and U.S. Department of Agriculture, 2016).

**Table 2.1. *Mi Vida Saludable* Targeted Behavioral Goals**

| Behavior Goal | Target | Focus |
|---|---|---|
| **Increase physical activity** | 30 minutes 5 days per week of moderate to vigorous physical activity | 1. Choose more physical activity<br>2. Choose more leisure time physical activity<br>3. Choose more physical activity while traveling<br>4. Choose less sitting/ sedentary activity |
| **Increase fruit and vegetable intake** | 5 or more servings of all fruits and vegetables per day | 1. Choose more non-starchy vegetables, leafy greens, cruciferous vegetables (excluding juices, potatoes, fried vegetables, legumes) |
| **Decrease intake of energy dense foods** | Decrease total dietary fat and saturated fat intake | 1. Choose animal protein low in fat (chicken without skin; lean ground meat; turkey or chicken deli slices; turkey or veggie burgers; meat with visible fat trimmed)<br>2. Choose dairy products low in fat (less cheese; low-fat or fat-free milks and yogurts)<br>3. Use less fat in cooking (oil instead of butter and lard; smaller, measured amounts of any type of fat while cooking; baked and broiled fish; baked potatoes and plantains) |
| | Decrease total added sugar intake | 1. Choose drinks with less added sugar (water, sparkling water, 1% or skim milk, unsweetened iced tea; coffee and tea without or low in added sugar)<br>2. Choose processed foods low in added sugar (certain yogurts; salad dressings and sauces; cereals)<br>3. Choose dessert foods low in added sugar (fresh, frozen, canned in its own juice, and baked fruit and plain yogurt) |

### 2.2.2 Step 2: Explore *determinants or potential mediators of change*

Step 2 involves identifying which potential determinants of behavior change are "modifiable influencers on, or predictors of, behavior change" for the selected behaviors and audience (Contento, 2015). Step 2 also examines the resources and modes of education that are most suitable for the selected behaviors and audience.

**Identifying Determinants or Potential Mediators of Change.** Targeting determinants, or *potential mediators,* in interventions is important to expedite and encourage behavior change (Carpenter, Finley, & Barlow, 2004; I. Contento, 2008; Contento, 1995, 2015; Greenlee et al., 2015). Potential mediators can be categorized as *motivating* or *facilitating*. *Potential motivating mediators* refer to types of information that can provide inspiration and incentives for behavior change and typically covered first to raise awareness of risks and benefits (Contento, 2015). *Potential facilitating mediators* refer to types of information can help people believe they are capable of taking on a behavior change (Contento, 2015) and are typically addressed after

participants have been motivated to take action and involve skills development that help participants make changes (Contento, 2015).

Table 2.2 outlines the possible potential mediators for this intervention based on a literature review and our research team's prior work with this population. *Outcome Expectations* are beliefs about the negative outcomes of current behaviors, and about positive outcomes or benefits of performing the recommended behavior [which] can be physical, social, or self-evaluative (Contento, 2015). Theory-based education programs have been shown to improve negative outcome expectations beliefs among breast cancer survivors 8-weeks and 6-months after different in-person and technology-enhanced lifestyle behavior-change interventions (Rogers et al., 2016; Stacey, James, Chapman, & Lubans, 2016).

**Table 2.2. General Objectives for *Mi Vida Saludable* Group Education and E-Communication Components Mapped to Corresponding Potential Mediators**

| Mediator Type | Potential Mediators | General Objectives<br>Participants will be able to… |
|---|---|---|
| Motivating potential mediators | Outcome expectations: Negative (Perceived Threat) | Evaluate their own behavior compared to recommendations and appreciate the risk of their current behaviors |
| | Outcome expectations: Positive (Perceived Benefits) | Demonstrate appreciation for importance of participating in target behaviors |
| | Perceived Barriers | Identify barriers to target behaviors |
| | Preferences | Demonstrate appreciation of different types and tastes of target foods and activities |
| Facilitating potential mediators | Social support | Demonstrate increased awareness of social support of participating in target behaviors |
| | Behavioral capability (nutrition- and physical activity-related knowledge and skills) | Identify strategies to meet recommendations |
| | Self-efficacy | Demonstrate increased confidence in participating in target behaviors |
| | Goal intention | State intention to improve target behaviors |

*Perceived Barriers* are "beliefs about the challenges or costs of taking action, which can be both personal and/ or tangible", and *self-efficacy* is "the confidence people have that they can carry out the intended behavior successfully" (Contento, 2015). Perceived barriers and self-efficacy are often paired, as people increase confidence when they feel they can overcome behavior-specific barriers (Contento, 2015). *¡Cocinar Para Su Salud!* found that self-efficacy

mediates increased fruit and vegetable intake in our target population (Shi et al., *in development*). Both self-efficacy and barriers have shown to significantly mediate physical activity after interventions at various time intervals up to 6 months (Phillips & McAuley, 2013; Pinto et al., 2009; Rogers et al., 2016; Stacey et al., 2016). In addition, qualitative research through semi-structured interviews highlights self-efficacy as a key influence on physical activity behavior change among breast cancer survivors (Short, James, & Plotnikoff, 2013).

*Social support* refers to "the support that individuals in social networks provide each other in various areas, and includes emotional, instrumental, information, and appraisal support"; *goal intention/ goal setting* includes "creating specific, measurable, attainable, realistic, and time-sensitive goals that […create a] sense of fulfillment from having achieved the goals" (Contento, 2015). Social support and goal setting may be important for continuing certain energy balance behaviors post interventions. For example both increased social support and goal-setting actions have been shown to significantly predict physical activity behavior, and to be common factors in successful educational programs, among breast cancer survivors in longitudinal settings (Phillips & McAuley, 2013; Short, James, Stacey, & Plotnikoff, 2013). Similar effects were seen with goal intentions after 8-weeks and 20-weeks of a similar intervention (Stacey et al., 2016).

*Preferences*, similar to "likings", signify the "innate inclination towards certain kinds of foods or activities that would determine a pattern of eating or activity behavior, which can be modified by repeated exposure to new tastes, foods, and activities through direct experiences" (Contento, 2015). *¡Cocinar Para Su Salud!* found preferences to mediate increased fruit and vegetable intake (Shi, *in development*). They are also included as a key potential mediator for *Mi*

*Vida Saludable* because food preferences have predicted dietary fat intake among breast cancer patients and survivors (Drewnowski, Hann, Henderson, & Gorenflo, 2000).

**Identifying Resources and Modes of Education**. Resources and modes of education take into account education level, literacy and numeracy skills, preferred learning styles, and social needs of the target audience. These were considered separately for the group education component and the e-communication component.

***Group education program***. As mentioned, the group education component of *Mi Vida Saludable* is based on the *¡Cocinar Para Su Salud!* Curriculum developed and implemented by this research team, and is thus briefly summarized here. The development of *¡Cocinar Para Su Salud!* is described in detail elsewhere (Aycinena et al., 2016). The current *Mi Vida Saludable* group education curriculum used the educational plans from *¡Cocinar Para Su Salud!* as templates (Aycinena et al., 2016).

The DESIGN Procedure was used to structure curriculum components. Formative assessments and focus groups identified facilitators and barriers common to Latinas and tested the degree of difficulty and appropriateness of program materials.

***E-communication program***. Since using electronic education was not a mode of communication used in the previous intervention *¡Cocinar Para Su Salid!,* focus groups were held to better understand which modes and devices of electronic content this population of Hispanic/ Latina breast cancer survivors would use for nutrition and physical activity information and inform the development of the e-communication component of *Mi Vida Saludable*.

*Focus group summary.* Participants were recruited at the university hospital oncology outpatient clinic through direct outreach to potential participants. Potential participants were 21

years of age or older, self-identified as Hispanic/ Latina, and self-identified as being at least 90 days post-treatment for breast cancer. Focus groups were conducted with four Spanish speaking ("Spanish") Latina women and four English speaking ("English") Latina women, separately (Table 2.3). English participants were mean age 54 years, and either had some college (50%) or a college degree (50%). Spanish speaking participants were slightly older (mean age 58.3 years) and 75% had a high school degree or less as their highest form of education. Most (75%) of women in both groups were Dominican and all had health insurance. Someone in households of Spanish participants used government food assistance. Focus groups lasted about 45 minutes and were led by 1-2 experienced bilingual researchers. Focus groups audio recordings were transcribed verbatim. The Columbia University Medical Center Institutional Review Board approved the study (IRB-AAAP0461). All participants provided written informed consent.

**Table 2.3. Demographic, socioeconomic, and health characteristics of focus group participants for development of e-communication component of *Mi Vida Saludable***

| | **Spanish-Speaking Group** n=4 n (%) | **English-Speaking Group** n=4 n (%) |
|---|---|---|
| **Age** | 58.3 | 54.0 |
| **Race/ Ethnicity** | | |
| Dominican | 3 (75%) | 3 (75%) |
| Cuban | 1 (25%) | - |
| Puerto Rican | - | 1 (25%) |
| **SNAP or WIC Participation** | | |
| SNAP or WIC | 4 (100%) | - |
| **Highest Education Level** | | |
| Some high school | 1 (25%) | - |
| High school graduate or GED | 2 (50%) | - |
| Some college but not a graduate | - | 2 (50%) |
| College degree | 1 (25%) | 2 (50%) |
| **Health Insurance** | | |
| Insured | 4 (100%) | 4 (100%) |
| **Health Insurance Type** | | |
| Medicaid | 4 (100%) | - |
| Medicare | 3 (75%) | 1 (25%) |
| HMO | - | 2 (50%) |
| POS Health Plan | - | 1 (25%) |
| **Breast Cancer Diagnosis** | 6.6 years | 8.9 years |
| *Time between diagnosis and focus group commencement* | | |
| **Breast Cancer Treatment** | | |
| Had surgery | 4 (100%) | 4 (100%) |
| Had chemotherapy treatment | 2 (50%) | 3 (75%) |
| Had radiation treatment | 1 (25%) | 1 (25%) |
| Had hormone therapy | 3 (75%) | - |

**Note**

SNAP = Supplemental Nutrition Assistance Program; WIC = Special Supplemental Program for Women, Infants, and Children; GED = General Education Development; HMO = Health Maintenance Organization; POS = Point of Service

Across both focus groups, women varied in their use of electronic devices, typically by age and income. Women who were older and with smaller household incomes were less comfortable with technology but were also much more receptive to contact by study staff by electronic means. Women more comfortable with technology used their smart phones often for physical activity phone applications, "apps", e.g. to track their exercise, as well as social media apps such as Instagram and Facebook to find new recipes. However, other women explicitly indicated they were "not attached" to their phones, and only looked at their phones and computers sporadically, primarily to stay in contact with friends and family. These women relied more heavily on TV shows for nutrition and cooking education and inspiration. All women discussed using certain websites to find nutrition information and shared recipes with others in their social networks. Women who were less comfortable with technology desired printed versions of nutrition and physical activity information compared to women who were more comfortable. All women preferred to have visuals accompanying educational text. Women specified that food-related images should include foods common in Hispanic/ Latina culture, as they typically did not find this aspect in the media. Women more comfortable with technology preferred 60 to 90 second videos, whereas women less comfortable were willing to spend up to 10 minutes. In addition, those less comfortable were willing to receive biweekly emails and weekly text messages, whereas women more comfortable viewed that frequency as intrusive.

Based on our previous work with this patient population in *¡Cocinar Para Su Salid!,* we understood we were likely to again recruit participants, for *Mi Vida Saludable,* who were at an average age of at least 50-60 years, and were less acculturated than average (i.e., 1.6-1.7 on a 5

point scale, where 5 is most acculturated to the English language) (Greenlee et al., 2015). Therefore, the resulting e-communication intervention included components emphasized by women in the focus groups who were older and less comfortable with technology.

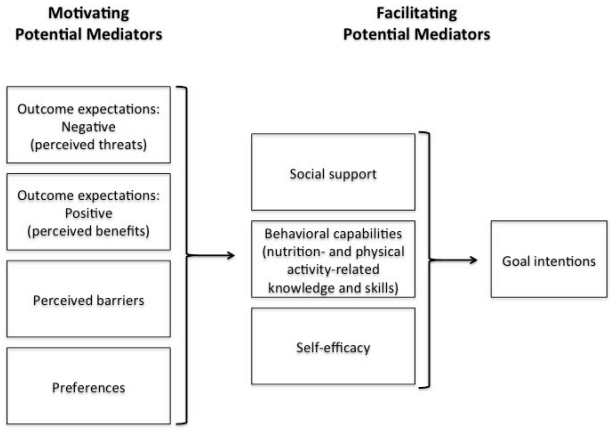
### 2.2.3 Step 3: Select *behavioral theory to guide program development*

Behavioral theories provide a map or guide for health educators when designing and implementing programs. These theories can be applied to various group demographics and dynamics and targeting different circumstances and behaviors (Contento, 2015). The identified potential mediators above, i.e. preferences, self-efficacy, barriers, goal-setting, and outcome expectations, align well with Social Cognitive Theory (SCT), which posits that behavior influenced by personal, social, and environmental factors (Bandura, 1977, 2004).

In addition, most randomized controlled trials (RCTs) explicitly using theory in their education interventions with female breast cancer survivors, have also used SCT, and many have seen positive behavioral results. Specifically, these RCTs have shown to significantly improve weekly physical activity and fruit and vegetable intake (Greenlee et al., 2015; Hatchett et al., 2013; Latka et al., 2009; Matthews et al., 2007; Pinto et al., 2013; Pinto et al., 2009). One SCT text-message based intervention to improve physical activity among breast cancer survivors, for example, found significant improvements in vigorous physical activity levels compared to control groups at 6 and 12 weeks of receiving the program (Hatchett et al., 2013). Another 12-week home-based SCT walking program increased minutes of physical activity significantly more than the control group (Matthews et al., 2007). *¡Cocinar Para Su Salud!* used both social cognitive theory and stages of change as its guiding frameworks, and successfully increased fruit and vegetable intake in the intervention group (Greenlee et al., 2015). Researchers for *Mi Vida*

*Saludable* decided to use SCT to frame the current study. A diagram of the modified version of SCT used for *Mi Vida Saludable* is shown in Figure 2.1.

**Figure 2.1. Modified Social Cognitive Theory for *Mi Vida Saludable***




Note: This model is based on Bandura, 2004

### 2.2.4 Step 4: Indicate *general objectives for key potential mediators*

General objectives are based on each identified potential mediator for each behavioral goal. They are used to guide the instructor, lesson, and ultimately participants in achieving the desired outcome of each potential mediator. General objectives for *Mi Vida Saludable* are listed in Table 2. For *negative outcome expectations*, the goal was for participants to be able to evaluate their own behavior compared to recommendations and appreciate the risk of their current behaviors, whereas for *positive outcome expectations*, the goal was for participants to be able to demonstrate appreciation for importance of participating in target behaviors.

As mentioned, perceived barriers and self-efficacy are closely related. The general objective for *perceived barriers* was to identify barriers to target behaviors, whereas the general objective for *self-efficacy* was to demonstrate increased confidence in participating in target behaviors. The goal for *preferences* was for participants to be able to demonstrate appreciation of

different types and tastes of target foods and activities. Other general objectives included aiming that participants would be able to demonstrate increased awareness of social support of participating in target behaviors (*social support),* identify strategies to meet recommendations (*behavioral capability*), and state intention to improve target behaviors (*goal intention*).

### 2.2.5 Step 5: Generate *educational plans based on general objectives, potential mediators and selected theory*

Generating plans begins the actual lesson development process, where fun, engaging, and relevant messages and activities are created. The process begins by creating matrices that outline the order of potential mediators addressed in each lesson along with strategies, specific objectives (derived from general objectives), and short descriptions of activities that align with each potential mediator. Using a matrix structure ensures that educational plans can systematically create purposeful, and likely effective, activities that are sequenced according to their theoretical structures for effective delivery (Contento, 2015).

In addition to psychosocial theories, nutrition and physical activity educational plans are based in instructional theory, which indicates that potential mediators that are facilitating should follow motivational potential mediators in order to better elicit behavioral change (Contento, 2015). In addition, instructional theory indicates that education should be conducted in the following sequence: educational discussions and activities should first Excite audiences, then Explain the content of the lesson, then Expand upon what was explained, and finally Exit with some concluding activities (Contento, 2015). This sequence is denoted as “The Four Es” (Contento, 2015). This way, nutrition and physical activity education follows a natural flow, allowing participants to easily follow and absorb the information presented (Contento, 2015).

Along these lines, both group education and e-communication components were developed to first focus on motivational potential mediators and then on facilitating ones. This approach first motivates participants to make change, then moves them to feel equipped to make changes on their own.

The group education component consisted of four hours for each session, with four sessions over a 1-month period. We decreased the number of sessions to four (from nine in *¡Cocinar Para Su Salud!*) so as to increase the potential of others to implement our intervention in the future, with respect to financial and personnel support. The first two sessions focused more heavily on the motivating potential mediators and the second two sessions focus more heavily on facilitating potential mediators, with all sessions incorporating both motivating and facilitating potential mediators. In addition, the beginning of all sessions is more focused on motivating and the end of each session focuses on facilitating potential mediators.

For the e-communication component (2-5 text messages per week, 11 months total), the first five and a half months of text messages are 2/3 motivational and 1/3 facilitating; and vice versa. Text-message implemented lifestyle interventions have indicated that providing text messages more often at first, and then decreasing the frequency over time is best practice (Schultz, 2012), which was why we decided to structure our intervention in the same manner.

**Group education component**: Educational plans (or "lesson plans") for the group education component of *Mi Vida Saludable* are outlined in Tables 2.4a-d. Group education activities were based on previous work with this population by this research team (Greenlee et al., 2015). Briefly, each session begins with an introduction and review of outcome expectations associated with the target behaviors. For sessions 2 through 4, goals made by each participant at the end of the previous session are reassessed as a group.

## Table 2.4a. Outline of Session 1 of Group Education Component for *Mi Vida Saludable*

| Instructional Theory Step | Potential Mediators | Strategy | Specific Objectives<br>Participants will be able to… | Activity |
|---|---|---|---|---|
| **Excite** | **Introduction**<br>30 minutes<br>*Overview of* Mi Vida Saludable *Program*<br>*Overview of AICR/ ACS Guidelines*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Social Support | Provide social support | Describe class context as a supportive environment | Introduce all group members and instructors to create supportive group environments |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Give PowerPoint presentation and discuss information about benefits of making the target behavior changes |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Give PowerPoint presentation and discuss striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Explain** | **Physical Activity Education**<br>35 minutes<br>*Lesson 1 Focus: Increasing physical activity at home*<br>Modes of Education: PowerPoint presentation; dance breaks; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Give PowerPoint presentation and discuss beneficial information of being more physically active |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by demonstrating behavior and providing practice by completing "dance breaks" |
| **Explain** | **Dietary Behaviors Education**<br>45 minutes<br>*Lesson 1 Focus: Decrease dietary fat & added sugar intake*<br>Modes of Education: PowerPoint presentation; group discussions; worksheets | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations for lowering fat and sugar intake | Give PowerPoint presentation and discuss information about benefits of eating a diet low in fat and added sugar |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of eating foods high in fat and added sugar | Provide striking statistics and other information about personal risk of negative outcomes of eating foods high in fat and added sugar |
| | Behavioral Capability | Provide factual knowledge related to behavior | Develop an understanding of identifying foods low in fat and added sugar and proper portion sizes of foods high in fat and added sugar | Provide factual information related to eating foods low in fat and added sugar involving remembering and understanding, using lectures, visuals, slides, and handouts |
| **Expand** | **Cooking**<br>90 minutes<br>*Lesson 1 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake*<br>Modes of Education: Cooking demonstration and guided practice | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Cook foods with lower fat and added sugar | Demonstrate food preparation/ cooking skills followed by guided practice with feedback through hands-on activities to develop cooking skills |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience |
| **Expand** | **Goal Setting**<br>10 minutes | | | |

| | | | | |
|---|---|---|---|---|
| | *Lesson 1: Create increasing physical activity goals*<br>Modes of Education: Worksheets | | | |
| | Perceived Barriers | Prompt identification of perceived barriers | Identify barriers | Group brainstorms barriers to goal behaviors and ways to overcome barriers |
| | Goal Intention/ Goal Setting | Stimulate action goal setting | State goal intentions and create goals | Teach goal setting skills for specific behaviors or actions, provide action planning forms |
| **Exit** | **Communal Meal**<br>20 minutes | | | |
| | Taste Preferences | Provide direct experience with healthful food | Consume foods low in fat and added sugar | As a group, consume meal low in fat and added sugar |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments eating together |

## Table 2.4b. Outline of Session 2 of Group Education Component for *Mi Vida Saludable*

| Instructional Theory Step | Potential Mediators | Strategy | Specific Objectives<br>Participants will be able to… | Activity |
|---|---|---|---|---|
| **Excite** | **Review of Goal Setting Plans**<br>10 minutes<br>*Lesson 2: Review increasing physical activity goals*<br>Modes of Education: Worksheets; group discussions | | | |
| | Goal Intention/ Goal Setting | Review action goal setting plans from previous session | State any changes to goal intentions | Discuss previous action plans making modifications if necessary |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments |
| **Excite** | **Review**<br>5 minutes<br>*Review of* Mi Vida Saludable *Program*<br>*Review of AICR/ ACS Guidelines*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Give PowerPoint presentation and discuss beneficial information of making the target behavior changes |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Give PowerPoint presentation and discuss striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Explain** | **Physical Activity Education**<br>65 minutes<br>*Lesson 2 Focus: Increasing recreational time physical activity*<br>Modes of Education: PowerPoint presentation; group discussions; group dance with Moving for Life™ | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Give PowerPoint presentation and discuss beneficial information of being more physically active |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by demonstrating behavior and providing practice by completing dance class with Moving for Life™ |
| **Explain** | **Dietary Behaviors Education**<br>40 minutes<br>*Lesson 2 Focus: Increase fruit and vegetable intake*<br>Modes of Education: PowerPoint presentation; group discussions; worksheets | | | |
| | Outcome Expectations (positive): | Provide information about positive outcomes of target | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations for increasing fruits | Give PowerPoint presentation and discuss beneficial information regarding eating a diet high in |

| | | | | |
|---|---|---|---|---|
| | Perceived Benefits | behavior | and vegetable intake | fruits and vegetables |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of eating a diet high in fruits and vegetables | Provide striking statistics and other information about personal risk of negative outcomes of eating a diet high in fruits and vegetables |
| | Behavioral Capability | Provide factual knowledge related to behavior | Develop an understanding of identifying non-starchy fruits and vegetables, serving sizes of fruits and vegetables needed per day, and where to find fruits and vegetables in the supermarket | Provide factual information related to eating a diet high in fruits and vegetables involving remembering and understanding, using lectures, visuals, slides, and handouts |
| **Expand** | **Cooking**<br>90 minutes<br>*Lesson 2 Focus: Cooking methods and recipes to increase fruit and vegetable intake*<br>Modes of Education: Cooking demonstration and guided practice | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Cook dishes high in fruits and vegetables | Demonstrate food preparation/ cooking skills followed by guided practice with feedback through hands-on activities to develop cooking skills |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience |
| **Expand** | **Goal Setting**<br>10 minutes<br>*Lesson 2: Create increasing fruit and vegetable goals*<br>Modes of Education: Worksheets | | | |
| | Perceived Barriers | Prompt identification of perceived barriers | Identify barriers | Group brainstorms barriers to goal behaviors and ways to overcome barriers |
| | Goal Intention/ Goal Setting | Stimulate action goal setting | State goal intentions and create goals | Teach goal setting skills for specific behaviors or actions, provide action planning forms |
| **Exit** | **Communal Meal**<br>20 minutes | | | |
| | Taste Preferences | Provide direct experience with healthful food | Consume dishes high in fruits and vegetables | As a group, consume dishes high in fruits and vegetables |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments eating together |

## Table 2.4c. Outline of Session 3 of Group Education Component for *Mi Vida Saludable*

| Instructional Theory Step | Potential Mediators | Strategy | Specific Objectives<br>Participants will be able to… | Activity |
|---|---|---|---|---|
| **Excite** | **Review of Goal Setting Plans**<br>10 minutes<br>*Lesson 3: Review increasing fruit and vegetable goals*<br>Modes of Education: Worksheets; group discussions | | | |
| | Goal Intention/ Goal Setting | Review action goal setting plans from previous session | State any changes to goal intentions | Discuss previous action plans making modifications if necessary |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments |
| **Excite** | **Review**<br>5 minutes<br>*Review of* Mi Vida Saludable *Program*<br>*Review of AICR/ ACS Guidelines*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Outcome Expectations | Provide information about positive | Demonstrate increased knowledge of benefits of | Give PowerPoint presentation and discuss beneficial information of |

| | | | | |
|---|---|---|---|---|
| | (positive): Perceived Benefits | outcomes of target behavior | following AICR/ ACS recommendations | making the target behavior changes |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Give PowerPoint presentation and discuss striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Explain** | **Physical Activity Education**<br>55 minutes<br>*Lesson 3 Focus: Increasing physical activity as transportation*<br>Modes of Education: Walking to the grocery store; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of increasing physical activity as transportation | Give PowerPoint presentation and discuss beneficial information of being more physically active via transportation |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by demonstrating behavior and providing practice by walking to the grocery store |
| **Explain** | **Additional Interactive Dietary Behaviors Education Activities**<br>40 minutes<br>*Lesson 3: Guided tour of supermarket* | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Demonstrate increased knowledge and skills of buying fruits and vegetables, foods low in fat and added sugar | Demonstrate shopping skills, tour the supermarket, followed by guided practice with feedback |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience by touring the supermarket |
| **Expand** | **Nutrition Education**<br>5 minutes<br>*Lesson 3 Focus: Decrease dietary fat & added sugar intake; increase fruit and vegetable intake*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS diet recommendations | Give PowerPoint presentation and discuss beneficial information regarding AICR/ ACS diet recommendations |
| **Expand** | **Cooking**<br>90 minutes<br>*Lesson 3 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake; and to increase fruit and vegetable intake*<br>Modes of Education: Cooking demonstration and guided practice | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Cook dishes that follow AICR/ ACS diet recommendations | Demonstrate food preparation/ cooking skills followed by guided practice with feedback through hands-on activities to develop cooking skills |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience |
| **Expand** | **Goal Setting**<br>10 minutes<br>*Lesson 3: Create decreasing dietary fat goals*<br>Modes of Education: Worksheets | | | |
| | Perceived Barriers | Prompt identification of perceived barriers | Identify barriers | Brainstorm with group barriers to goal behaviors and ways to overcome barriers |
| | Goal Intention/ Goal Setting | Stimulate action goal setting | State goal intentions and create goals | Teach goal setting skills for specific behaviors or actions, provide action planning forms |
| **Exit** | **Communal Meal**<br>20 minutes | | | |
| | Taste Preferences | Provide direct experience with healthful food | Consume dishes that follow AICR/ ACS diet recommendations | As a group, consume dishes that follow AICR/ ACS diet recommendations |
| | Social Support | Enhance skills in | Evaluate class context as a | Create supportive group environments |

| | | | | |
|---|---|---|---|---|
| | | management of social context | supportive environment | eating together |

## Table 2.4d. Outline of Session 4 of Group Education Component for *Mi Vida Saludable*

| Instructional Theory Step | Potential Mediators | Strategy | Specific Objectives<br>Participants will be able to… | Activity |
|---|---|---|---|---|
| **Excite** | **Review of Goal Setting Plans**<br>10 minutes<br>*Lesson 4: Review decreasing dietary fat goals*<br>Modes of Education: Worksheets; group discussions | | | |
| | Goal Intention/ Goal Setting | Review action goal setting plans from previous session | State any changes to goal intentions | Discuss previous action plans making modifications if necessary |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments |
| **Excite** | **Review**<br>5 minutes<br>*Review of* Mi Vida Saludable *Program*<br>*Review of AICR/ ACS Guidelines*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Give PowerPoint presentation and discuss beneficial information of making the target behavior changes |
| | Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Give PowerPoint presentation and discuss striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Explain** | **Physical Activity Education**<br>30 minutes<br>*Lesson 4 Focus: Decreasing sedentary time*<br>Modes of Education: Walking around the park before the farmers' market; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of decreasing sedentary time | Give PowerPoint presentation and discuss beneficial information of decreasing sedentary time |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by demonstrating behavior and providing practice by decreasing sedentary time by walking around a park before shopping at the farmers' market |
| **Explain** | **Additional Interactive Dietary Behaviors Education Activities**<br>45 minutes<br>*Lesson 4: Guided tour of farmers' market* | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Demonstrate increased knowledge and skills of buying fruits and vegetables, foods low in fat and added sugar | Demonstrate shopping skills, touring the farmers' market, followed by guided practice with feedback |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience by touring the farmers' market |
| **Explain** | **Nutrition Education**<br>10 minutes<br>*Lesson 4 Focus: Decrease dietary fat & added sugar intake; increase fruit and vegetable intake*<br>Modes of Education: PowerPoint presentation; group discussions | | | |
| | Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS diet recommendations | Give PowerPoint presentation and discuss beneficial information regarding AICR/ ACS diet recommendations |
| **Expand** | **Cooking** | | | |

| | | | | |
|---|---|---|---|---|
| | 90 minutes<br>*Lesson 4 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake; and to increase fruit and vegetable intake*<br>Modes of Education: Cooking demonstration and guided practice | | | |
| | Behavioral Capability | Provide active mastery experiences/ guided practice | Cook dishes that follow AICR/ ACS diet recommendations | Demonstrate food preparation/ cooking skills followed by guided practice with feedback through hands-on activities to develop cooking skills |
| | Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience |
| **Expand** | **Goal Setting**<br>10 minutes<br>*Lesson 4: Create decreasing added sugar goals*<br>Modes of Education: Worksheets | | | |
| | Perceived Barriers | Prompt identification of perceived barriers | Identify barriers | Group brainstorms barriers to goal behaviors and ways to overcome barriers |
| | Goal Intention/ Goal Setting | Stimulate action goal setting | State goal intentions and create goals | Teach goal setting skills for specific behaviors or actions, provide action planning forms |
| **Exit** | **Communal Meal**<br>20 minutes | | | |
| | Taste Preferences | Provide direct experience with healthful food | Consume dishes that follow AICR/ ACS diet recommendations | As a group, consume dishes that follow AICR/ ACS diet recommendations |
| | Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments eating together; distribution of certificates of completion of *Mi Vida Saludable* program |

The next portion of the educational plan focuses on physical activity education. Each session emphasizes a different type of physical activity, as a way to systematically and easily discuss how more activity can be included throughout the day, based on International Physical Activity Questionnaire (IPAQ) categories (Nicaise, Crespo, & Marshall, 2014), which include a) increasing household activities, e.g. mopping; b) increasing activity as transportation, e.g. walking, 3) increasing recreational activity, e.g. going to the gym, and d) decreasing sedentary time, e.g. sitting while watching television. Different activities are included in the sessions to emphasize these various methods of increasing activity, such dancing as recreational activity and walking to the grocery store and farmers' market as a mode of transportation.

Activities about the dietary behavioral goals are the focus of the next portion of each session. The first session emphasizes decreasing fat and added sugar; the second emphasizes

increasing fruit and vegetable intake; and the third and fourth sessions review all dietary behaviors. Sessions 1 and 2 teach main concepts through PowerPoint presentations; in Sessions 3 and 4 women are taken on grocery store and farmers' market tours, respectively.

The last portion of each session involves cooking education where women directly take part in cooking culturally relevant recipes lower in fat and sugar, and higher in fruits and vegetables, than typically prepared, and eating the prepared meal together. Sessions conclude with women brainstorming barriers to completing the target behaviors. Women complete goal-setting worksheets for each behavior.

***E-communication component***: Plans for the e-communication component of *Mi Vida Saludable* are outlined in Table 2.5. This interactive e-communication component is 11 months total in length, beginning immediately after the group education component is complete (for those randomized to both, or e-communication only, conditions) includes both text messages and emails, which are sent via software "eHIP", the eHealth & Intervention Platform, created by the University of Arizona (University of Arizona, 2018). Using this software, study staff are able to respond back to participants' emails and text messages within the program. Text messages and emails are uploaded in bulk prior to the start of the program. Days of the week and times per day that text messages and emails are sent are randomly assigned to each text message. Study staff are able to respond to text messages and emails from participants through a web-based portal.

**Table 2.5. Outline of E-communication Education Component for *Mi Vida Saludable***

| **Instructional Theory Step** | **Text message types** | | | Week 1 n (%) | Weeks 2-23 n (%) | Weeks 24-45 n (%) | Week 46 n (%) | Example text message |
|---|---|---|---|---|---|---|---|---|
| Excite | Introduction to E-Communication Program | | | 2 (1.6) | | | | Welcome to Mi Vida Saludable text messages! You'll learn ways to improve your health through physical activity and healthy eating. |
| Explain | Physical | Motivating | Total Messages[4] | 1 (0.8) | 15 (12.2) | 8 (6.5) | | Even though physical activity may be tiring at |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Activity | Messages | | | | | first, regular physical activity actually makes you feel energized! |
| | | | Messages with accompanying Newsletter[1] | 3 (2.4) | 1 (0.8) | | Being physically active can help you manage your weight. Every little bit counts! Click here for the Mi Vida Saludable News to see how being physically active can benefit the whole body (also in your email!) *Link* |
| | | | Messages with accompanying link to external source[2] | 2 (1.6) | 1 (0.8) | | Bond with others by doing a free yoga class in the city. Click here to find out where they are: *Link* |
| | | | Total Messages[4] | 8 (6.5) | 14 (11.4) | 1 (0.8) | Aim for 30 minutes of physical activity 5 days per week. Walk towards this goal — to the store or while on your cell phone! |
| Expand | | Facilitating Messages | Messages with accompanying Newsletter[1] | 2 (1.6) | 4 (3.3) | | For a fun activity together, ask a friend or family member to take walks with you around the block, to the store, or to the park. Click here for the Mi Vida Saludable News for ideas of how to be active with friends and family. *Link* |
| | | | Messages with accompanying link to external source[2] | 3 (2.4) | 0 (0.0) | | Dance the night (and day!) away with this video from Moving for Life *Link* |
| | | | Total Messages[4] | 15 (12.2) | 9 (7.3) | | Cut fat by limiting how much meat you're eating. Some meats have more fat than others – try to avoid bacon, sausage, and ham. |
| Explain | Nutrition | Motivating Messages | Messages with accompanying Newsletter[1] | 5 (4.1) | 2 (1.6) | | At the farmers' market, foods are generally low in fat and sugar - shop at your local farmers' market this week! Click here to learn where to find a market near you and a tasty vegetable frittata recipe in Mi Vida Saludable News (also in your email!) *Link* |
| | | | Messages with accompanying link to external source[2] | 2 (1.6) | 3 (2.4) | | Try this Herbed Quinoa recipe as a rice substitute. And quinoa is quick, delicious, and easy to make. *Link* |
| | | | Total Messages† | 7 (5.7) | 14 (11.4) | 1 (0.8) | Think about the MyPlate proportions when shopping – fill ½ your cart with fruits and vegetables! |
| Expand | | Facilitating Messages | Messages with accompanying Newsletter[1] | 2 (1.6) | 3 (2.4) | | Sometimes chips can seem like an easier snack than fruits and vegetables - instead try baked spiced chickpeas! In this |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | newsletter (also in your email) try the recipe and learn where sugary snacks hide in the grocery store *Link* |
| | | | Messages with accompanying link to external source[2] | 2 (1.6) | 1 (0.8) | There is a lot of fat in French fries, fried plantains, fried yucca, and potato chips. Try this recipe for baked "fries" – you'll love the taste! *Link* |
| Expand | Goal Setting[3] | Physical Activity | | 2 (1.6) | 2 (1.6) | Set a goal for being more active at home - walk while on the phone, dance to videos, or dance while you clean. Make a goal: How often will you be more active at home next week? Text back your response.<br>1= one time<br>2= two to three times<br>3= about every day |
| | | Nutrition | | 3 (2.4) | 2 (1.6) | Make a goal: How often do you think you can choose water or unsweetened coffee or tea this week instead of sweetened drinks? Text back your response<br>1= one time per week<br>2= two to three times per week<br>3= almost every day<br>4= every day |
| Exit | Departure from E-Communication Program | | | | 1 (0.8) | This is the end of the Mi Vida Saludable text messages! Thank you for your participation. |

Note: [1]All newsletters also sent out at the same day and time via text messages and email
[2]Additional links include MFL dance videos, local outdoor events incorporating physical activity around the city, and CFYL recipes
[3]Goal setting text messages are interactive and ask participants to indicate how often they can make behavioral changes. Goal setting text messages also include a follow-up text message the next week.
[4]Example text messages for "Total Messages" are without accompanying newsletters or links to external sources

Content of text messages was mapped to the already developed group education curriculum so that both components had similar information. Text messages include both motivational and facilitating messages. Half of the text messages focus on physical activity, i.e. increasing minutes of weekly physical activity, and half focus on diet, i.e. increasing fruit and vegetable intake, and decreasing fat and added sugar intake. Once a month, text messages prompt women to set goals, half of which are each related to physical activity and diet, by asking women to respond to a goal setting question, e.g. "Make a goal: How often do you think you can

choose a low fat meat such as 90-95% lean ground meat or chicken without the skin this week? Text back your response: 1= one time per week, 2= two to three times per week, 3= almost every day, 4= every day". One week after these goal-setting messages are sent, another message asks for feedback, e.g. "Remember, last week we asked you to set a goal to eat less fat from meat or chicken this past week? How many times did you do it? Text back your response. 1= one time this week, 2= two to three times this week, 3= almost every day, 4= every day". Goal setting text messages were set on Sundays and Mondays, as research, albeit with primarily White populations, shows that these days prompt better goal setting behaviors (Ayers, Althouse, Johnson, Dredze, & Cohen, 2014).

Newsletters are live on the secure CFYL website, only available on certain pages for our participants. The intervention protocol calls for participants to receive them via links embedded in emails and text messages sent out at the same time and day via both platforms, so that women can access them in whichever mode they prefer. Half of the newsletters' content target physical activity, and half target diet, evenly distributed throughout a 11-month intervention. The newsletters are colorful and engaging; they each begin with a welcoming introduction from a member of the study staff and then include motivating or facilitating nutrition and activity information, as dictated by the education structure. In addition to newsletters, other links sent via text messages include links to Moving for Life™ (MFL) dance videos, New York City government sponsored events incorporating physical activity around the city, and CFYL recipes. MFL is a non-profit organization leading cancer recovery through exercise (Moving For Life, 2017).

All text messages and newsletters were reviewed by a multidisciplinary team including five senior researchers in the field of lifestyle-factor behavior change, two community leaders, and the Mi Vida Saludable study coordinator.

**Pilot Study**: A pilot study was conducted between October 2015 and March 2016. The Columbia University Medical Center Institutional Review Board approved the study (IRB-AAAP0461) and all participants provided written informed consent. Similar to the focus group, participants were recruited at the university hospital oncology outpatient clinic through direct outreach to potential participants. Potential participants were 21 years of age or older, self-identified as Hispanic/ Latina, and self-identified as being at least 90 days post-treatment for breast cancer. Many dozen were screened; nineteen participants consented into to the pilot study. Most participants (58%) were Dominican, half (47%) were participants of the Supplemental Nutrition Assistance Program (SNAP), and just less than half (42%) had a high school education or less. The majority (95%) had health insurance and the majority (63%) had Medicare or Medicaid.

The full group-education component was piloted, followed by a shortened version of the electronic component. After the pilot study was completed, a formative evaluation of the intervention was conducted with the participants. On a scale of 1 to 5 where 5 indicates greatest satisfaction, participants were very satisfied with both group-education and electronic portions of the intervention (range of mean responses 4.8 – 5.0 for the group education portion, and the range of mean responses 4.0 – 4.8 for the electronic education portion). Major changes to the group-based education included the addition of answers to common dietary questions focusing on evidence-based responses to questions about fad diets.

In addition, after each group education class, the researchers and nutrition educators discussed how to improve each session. Most changes were logistical; focusing on transportation to and from the field trips to the grocery story and farmers' market, and regarding when and where the meal and snack prep for each session should take place.

### 2.2.6 Step 6: Nail *down evaluation plan for the education program*

It is important to design the evaluation plan at the same time as the intervention itself so as to ensure that both potential mediators and behavior goals are measured. This provides information useful to determine mechanisms of behavior change, and for future interventions. The specific assessment methods used on the Mi Vida Saludable trial are described below.

Baseline data were collected during two separate in-person baseline sessions, one to three weeks apart, i.e. "Baseline 1" and "Baseline 2". The second baseline session was completed two-to-three weeks prior to the start of the classroom-based intervention arm. Data collectors did not provide any nutrition or physical activity education for the classroom-based intervention. The following data types are collected at baseline, 6, and 12 months.

**Behavior: Physical Activity.** Physical activity is measured by the Seven-Day Physical Activity Recall (PAR), which is a brief assessment designed to gauge the amount of time spent engaged in various types of physical activity. It was administered by study staff who were trained to follow a standardized protocol, which has been previously validated in many populations including Latino adults (Blair et al., 1985; Rauh, Hovell, Hofstetter, Sallis, & Gleghorn, 1992; Sallis et al., 1985).

The 7DPAR yields a composite score that includes both the duration and intensity of physical activities participants engaged in during the past week. During data collection, physical

activities are categorized as “moderate” (e.g., yoga, sweeping, walking 3-4 mph), “hard” (e.g., aerobic dance, fast walking, scrubbing floors), or “very hard” (e.g., circuit training, jumping rope, cross-country running). Participants were asked how many minutes they spent in the past 5 weekdays (weekdays determined by participants, e.g. if they worked on weekend days and had no work on certain days other than Saturday or Sunday) and weekend days doing activities in each of the 3 categories. Total weekly hours spent in each activity category, as well as category type, were calculated. 7DPAR was assessed during Baseline 2.

**Behaviors: Fruit and Vegetable Intake, Dietary Fat and Added Sugar Intake.**

Dietary intake was assessed using two to three 24-hour recall assessments using the multiple pass approach with the software program NDSR (versions 2016-2017, developed by the Nutrition Coordinating Center, University of Minnesota) (Dwyer, Picciano, & Raiten, 2003), which has been used frequently to measure dietary intake in a variety of Hispanic populations (Greenlee et al., 2015; Keller et al., 2014; Kieffer et al., 2014; Schneiderman, Chirinos, Aviles-Santa, & Heiss, 2014).

Two of the recalls assessed diet for weekdays and one assessed diet for a weekend day. These assessments took place during a two-to-three week period; one recall was completed in person during the second baseline visit, and the other two recalls were completed over the phone in between the second baseline visit and the start of the classroom-based intervention. Participants were trained by research staff on how to estimate portion size during the recall sessions at their Baseline 2 visit with food models and the NDSR *Food Amounts Booklet*. The *Food Amounts Booklet* is given to participants to take home to use during their phone-based sessions. If participants lose their booklets, they are mailed new ones by study staff.

A certified NDSR data collector (by the Nutrition Coordinating Center, University of Minnesota) trained research staff over a two-to-three week period before data collection occurred. The training, based on the certification training manual and procedures, included a detailed review of the NDSR database, oversight of recall procedures, and 10-15 practice recalls until the certified data collector deemed the data collectors' recalls as sound.

The certified NDSR data collector also assessed all 24-hour recalls for quality assurance, examining portion size and food types selected for accuracy in reporting. NDSR output provides data on average number of servings of fruits and vegetables per day by fruit and vegetable subgroup, percent daily calories of fat per day, and grams of added sugar per day.

**Potential Mediators.** As self-efficacy and preferences have been shown to be effective in this population specifically (Shi, In progress), these were the potential mediators selected to be assessed in the evaluation plan. Self-efficacy and preferences were assessed via *Social Cognitive Theory Potential Mediator Questionnaire for Latinas*; a validated questionnaire assessing these potential mediators rooted in Social Cognitive Theory, discussed in detail elsewhere (Paul, Koch, Contento  Greenlee, *in development*). Briefly, self-efficacy and preferences are assessed in Likert-scale fashion of physical activity, fruit and vegetable intake, and intake of dietary fat and added sugar. Preferences for various activities and diet choices are assessed from 1-5 (*strongly dislike* to *strongly like*); an option was available for "never tried it", marked as "0". Self-efficacy choices also ranged from 1-5 (*not at all confident* to *extremely confident*). Scales were assessed via self-report and participants were assisted by study staff if appropriate. The survey took between 15-30 minutes to complete, and was assessed at Baseline 1.

## 2.3 DISCUSSION

The DESIGN Procedure was used to develop a group education components and online component with text messaging intervention for Hispanic/ Latina breast cancer survivors, *Mi Vida Saludable*. The intervention is currently underway, n=95 have been randomized for the first three, of five, cohorts (as of February 2018). The intervention targets four key behaviors: 1) increasing fruit and vegetable intake; 2) increasing daily physical activity; 3) decreasing added sugar intake; and 4) decreasing fat intake. The *Mi Vida Saludable* program is based in Social Cognitive Theory. While the DESIGN procedure has previously been used in other settings, including separately in, group education and on social media (Aycinena et al., 2016; Paul et al., *in development*), this is the first study that we are aware of to develop an educational program which similar information for both in-person group education and e-communication mediums. This is also one of the first studies to use, and outline in detail, a systematic process to develop such a program for a racial/ ethnic minority population.

The DESIGN Procedure was used to develop a similar intervention for Hispanic/ Latina breast cancer survivors by our research group, *Cocinar Para Su Salud*, which focused only on improving fruit and vegetable intake and dietary fat intake, *Mi Vida Saludable* adds the following target behaviors: increasing daily physical activity and decreasing added sugar intake (Aycinena et al., 2016). Further, *Cocinar Para Su Salud* was a nine session group education-based only intervention, whereas *Mi Vida Saludable* involves four group education-based sessions and 11 months of e-communication education (emails, text message, and website access) (Aycinena et al., 2016). Both interventions were based on Social Cognitive Theory.

There are benefits to using the DESIGN Procedure. Interventions have shown to be more effective if they are behaviorally-focused, theory-based, and use associated potential mediators to guide the development of the program (Contento, 2015; Katz et al., 2008). Further, as dietary and physical activity behaviors are complex, DESIGN allows developers to create a theory-based model and specific potential mediators that have been shown to influence a certain behavior for the target group (Contento, 2015). In addition, DESIGN allows for very clear modes of evaluation specifically targeted to determine change in the key behaviors and psychosocial potential mediators on which the intervention is based (Contento, 2015). A distinction of the *Mi Vida Saludable* curriculum is that it is very clearly behaviorally-focused and theory-based, but it is also specifically culturally tailored and follows instructional theory, so that the material is presented in a natural, flowing process, whether in-person or by virtual means.

The current study fills a number of gaps in the published literature, as next described. Translating theory-based potential mediators into educational objectives, and then identifying related, previously documented behavior change strategies and activities, allows researchers to develop similar programs across demographic groups and across various behavior change goals, as well as to compare outcomes more consistently (Contento, 2015). This consistent explicit education development method is not often described in detail, which disables researchers from creating and implementing similar programs themselves. In addition, as published guidelines for developing culturally-tailored educational programs among racial/ ethnic minority populations do not exist, and there are therefore limited resources for Hispanic/ Latina groups, this detailed description of *Mi Vida Saludable,* along with *Cocinar Para Su Salud,* provides a strong basis for future interventions with our detailed descriptions. Further, *Mi Vida Saludable* was developed to help Hispanic/ Latina women feel connected in terms of language and community, which has

been shown as a strong desire among this group (Castro, Barrera, & Holleran Steiker, 2010). This intervention description is also unique and useful for future researchers in that it describes in detail how to develop simultaneous interventions using different mediums, i.e. electronic and classroom based.

This study illustrates how developers of future programs targeting diverse and racial/ ethnic minority populations can use the systematic framework the DESIGN procedure described here to create theory- based nutrition and physical activity interventions. Our study is especially unique in that it is the first to use DESIGN to develop a text message, email, and website based intervention. Both researchers and practitioners can follow the step-by-step process of DESIGN to tailor education to their populations' needs, and more research is needed to test this method.

Also, the DESIGN procedure complements other well-known procedures such as the RE-AIM framework (Glasgow et al., 2003; Glasgow et al., 1999), and the PRECEDE-PROCEED model (Green, 1991; Phillips, Rolley, & Davidson, 2012), which are useful in identifying components of interventions to target do not provide detailed descriptions on how to translate potential mediators into specific educational objectives and behavior change strategies, as DESIGN specifies detailed development of educational plans, whereas the PRECEDE-PROCEED and RE-AIM target larger-scale interventions. One process, other than DESIGN, which is used on the micro-level is Baranowski's method of designing, developing and evaluating obesity prevention-related studies (Baranowski et al., 2009). Another example method is Intervention Mapping, however this method is extensive and complicated and generally is not suitable for practitioners (Bartholomew, Parcel, & Kok, 1998).

When educational programs are developed without describing their developmental process, replication and identification of effective potential mediators and strategies is very

difficult. With a clear description using a systematic process, researchers and practitioners are able to conserve resources and move the field of behavior change forward more quickly and effectively. Further research can enhance the usefulness of the procedure by investigating whether certain parts of DESIGN are more important than others.

## 2.4 REFERENCES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# CHAPTER 3 ARTICLE 2: THE PREFERENCES AND SELF-EFFICACY OF DIET AND PHYSICAL ACTIVITY BEHAVIORS QUESTIONNAIRE FOR LATINAS: DEVELOPMENT AND TESTING OF VALIDITY AND RELIABILITY

## 3.1 INTRODUCTION

Breast cancer incidence rates are the highest of all cancer diagnoses; in 2015, nearly 232,000 women were diagnosed with breast cancer, accounting for 14 percent of new cancer cases in the US (Howlader N). Following lifestyle, i.e. diet and physical activity, recommendations during and post-treatment have shown to improve morbidity and mortality from breast cancer and other chronic diseases (Demark-Wahnefried, Winer, & Rimer, 1993; Lajous, Mozaffarian, Mozaffarian, Schrag, & Adami, 2011; McTiernan, 2005; Patterson, Cadmus, Emond, & Pierce, 2010). These guidelines, recommended by the American Institute for Cancer Research (AICR) and the American Cancer Society (ACS), include being physically active and consuming a diet high in fruits and vegetables and low in energy dense foods, i.e. foods high in fat and sugar (Kushi et al., 2012; Rock et al., 2012).

Despite these recommendations, national data indicate that most breast cancer survivors are not adhering to these guidelines; most women eat fewer than five cup-equivalents of fruits and vegetables each day (mean 0.9 ± 0.1 cups of fruits; 1.6 ± 0.13 cups of vegetables), and consume more than the recommended 10% of daily calories from solid fats, alcohol, and added sugar (Milliron, Vitolins, & Tooze, 2014). Further, only 29.6-47.3% of breast cancer survivors meet physical activity recommendations (150 minutes of moderate to vigorous activity per week)

(Blanchard, Courneya, Stein, & American Cancer Society's SCC-II, 2008; LeMasters, Madhavan, Sambamoorthi, & Kurian, 2014).

In addition, disparities worsen morbidity and mortality outcomes, particularly for Latina populations (Arandia, Nalty, Sharkey, & Dean, 2012; Lopez, Agullo, & Lakshmanaswamy, 2013; Ooi, Martinez, & Li, 2011). While Hispanic women have lower incidence of breast cancer than non-Hispanic whites, they are at greater risk of cancer recurrence and are 20% more likely to die of breast cancer than non-Hispanic Whites (Ooi et al., 2011). These disparities may be due to inaccessibility to health care (Adams, Barnes, & Vickerie, 2008), higher rates of diabetes and obesity (Hedley et al., 2004), and lower rates of physical activity (Schoenborn & Heyman, 2009).

Current practice to educate cancer patients on diet and physical activity guidelines includes a brief consultation with a clinician and/ or dissemination of print information (Institute of Medicine of the National Academies, 2005). However, using behaviorally focused, theory-based, and culturally-tailored education interventions have consistently shown to be more effective than dissemination of information alone; targeting potential mediators of behavior change based on psychosocial theories is important to expedite and encourage behavior change (Carpenter, Finley, & Barlow, 2004; I. Contento, 2008; I. R. Contento, 1995, 2015; Greenlee et al., 2015).

Assessing these mediators to better understand which of them influence behavior change can help interventionists efficiently improve programs and ultimately lifestyle behaviors. However, there is a lack of qualified instruments to measure psychosocial mediators of behavior change in general, and especially for cancer survivors and Hispanic populations.

The aim of this study is to test for validity and reliability of the mediator questionnaire for the NIH-funded R01 trial *Mi Vida Saludable ("My Healthy Life")*, entitled *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*, which measures the psychosocial mediators *self-efficacy* and *preferences* among urban Latina breast cancer survivors participating in the study.

The *Mi Vida Saludable* study, which began in 2016, is a randomized controlled trial, which aims to ultimately determine separate and synergistic effects of theory-based classroom- and electronic-nutrition and physical activity-education (n=95 randomized as of October 2017). Women are enrolled in *Mi Vida Saludable* in cohort groups of approximately 40 participants to best facilitate the classroom-portion of the intervention. The *Mi Vida Saludable* intervention is based on a previously conducted smaller-scale classroom-based randomized controlled trial *¡Cocinar Para Su Salud!* (Cook for Your Health!) with Latina breast cancer survivors, which significantly improved fruit and vegetable intake by two servings per day (Greenlee et al., 2015).

## 3.2 METHODS

*The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* was created to measure mediators from social cognitive theory (SCT) of each of the four target behaviors of the *Mi Vida Saludable* intervention: 1) increase physical activity, 2) increase fruit and vegetable intake, 3) decrease dietary fat, and 4) decrease added sugar intake. A detailed description of the intervention's development is explained elsewhere (H, In development).

Most RCTs explicitly using theory in their interventions with female breast cancer survivors have used Social Cognitive Theory (SCT), which posits, in brief, that behavioral, personal and environmental factors synergistically determine behavior (Bandura, 1977). These interventions have shown to significantly improve weekly physical activity and fruit and vegetable intake (Greenlee et al., 2015; Hatchett, Hallam, & Ford, 2013; Latka, Alvarez-Reeves, Cadmus, & Irwin, 2009; Matthews et al., 2007; Pinto, Papandonatos, & Goldstein, 2013; Pinto, Rabin, & Dunsiger, 2009; Tate et al., 2016). Among SCT's personal factors, the constructs of *self-efficacy* and *preferences* have been shown to effectively mediate behavior change in breast cancer survivors participating in the earlier study *¡Cocinar Para Su Salud!* (Shi, et al., *In development*), these were the mediators selected for further exploration here. An outline of the final questionnaire is shown in Tables 1 and 2. *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* was developed in English and Spanish, but validity and reliability for this article assess the Spanish version, as *Mi Vida Saludable* is delivered in this language.

### 3.2.1 Initial Instrument Development

Similar, albeit few, existing interventions targeting cancer survivors and/ or Latinas have indicated that physical activity perceived benefits, perceived barriers, and self-efficacy should be assessed and targeted (James et al., 2011). Self-efficacy questions were thus taken from and modified from scales used in the Exercise and Nutrition Routine Improving Cancer Health (ENRICH) trial (James et al., 2011; Plotnikoff & Blanchard, 2001), validated with an adult population: 54.6% female, mean age 40.7 years (SD=11.1), mean BMI 23.9, 30.5% received university degree (Plotnikoff & Blanchard, 2001).

Research suggests that the mediators of self-efficacy, preferences, and perceived barriers, are more important than others in changing fruit and vegetable intake, dietary fat intake, and sugar intake (Doerksen & McAuley, 2014; Greenlee et al., 2015). Scales assessing preferences for all behaviors and self-efficacy for diet-related behaviors were modified versions of the National Cancer Institute's (NCI) Food Attitudes and Behaviors (FAB) Survey, which already provides these question types for fruit and vegetable behaviors (but not related to dietary fat and added sugar) (Erinosho et al., 2015). Preferences for specific foods were based on foods targeted in the *Mi Vida Saludable* intervention, specifically those foods highlighted in the meals and recipes participants took part in preparing in the classroom component and those foods highlighted and encouraged in emails and texts in the electronic communication component of the intervention. These foods were mostly vegetables (versus fruits). A description of the *Mi Vida Saludable* intervention can be found in Chapter 2 of this dissertation.

As the NCI FAB includes individual fruits and vegetables, this section in our questionnaire was constructed similarly, asking participants about their experiences with unique items. However, other psychosocial questionnaires examining mediators of fat and sugar intake, while limited, group similar foods together, e.g. tea and coffee with added sugar (Contento, Koch, Lee, & Calabrese-Barton, 2010; Contento, Koch, Lee, Sauberli, & Calabrese-Barton, 2007). Therefore, self-efficacy and preference questions for foods high in fat and sugar were grouped according to their similar properties. The NCI FAB survey has been validated with an adult population: 53% female, 69% 35 years of age and above, 67% BMI $\geq$ 25, 26% received college degree or higher, 73% non-Hispanic white/ other, 27% non-Hispanic black (Erinosho et al., 2015). All questionnaires were translated into Spanish by a bilingual research team member. They were then reviewed by a group of 3 (JS, AMC, DH) bilingual team members, and finally

and reviewed for accuracy by a certified bilingual translator. Any questions about a translated word or phrase were discussed among the staff to come to a conclusion.

### 3.2.2 Validity and Reliability of Mediator Questionnaire

Expert panel review assessed content validity. The expert panel consisted of five senior researchers (HG, PAK, RW, IRC, HLG) in the field of lifestyle-factor behavior change, two community leaders (AO, JS), and the Mi Vida Saludable study coordinator (AMC) who all have expertise and direct involvement with the target population. Participants from the target population provided information for validity and reliability assessments through 1) content validity, 2) internal consistency reliability, and 3) test-retest reliability methods.

**Assessment of Content Validity by Expert Panel Review.** Content validity assesses the degree to which the instrument measures the construct of interest, and is achieved by experts familiar with the construct of interest reviewing all of the questionnaire items for readability, clarity and comprehensiveness (Bolarinwa, 2015). Experts agree as to which items should be included in the final questionnaire (Bolarinwa, 2015; Fitzner, 2007). The expert panel of researchers listed above reviewed whether *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* accurately assessed mediators of each target behavior and assessed whether the questionnaire was legible and understandable for the target population to establish content validity.

**Assessment of Face Validity with Cognitive Interviews**. Face validity is established by reviewing a questionnaire briefly, or at "face value". It is often said to be a "casual" form of validity (Bolarinwa, 2015). Face validity is often paired with content validity to increase validity strength of the questionnaire (Bolarinwa, 2015). Cognitive Interviews can assess face validity. A

small number of participants were recruited to assess cognitive questioning, which is a process used to detect problems respondents have in understanding survey instructions, items, and in formulating answers. Participants were recruited from the Columbia University Medical Center oncology outpatient clinic and direct outreach to potential participants. Potential participants were 21 years of age or older, self-identified as Hispanic or Latina, self-identified as being at least 90 days post-treatment for breast cancer, and could read and write Spanish. Participants received public transit travel reimbursement and a $20 gift card for their participation.

One focus group with four Spanish-speaking women was conducted for 45 minutes. The focus group was led by 1 experienced bilingual researcher and was audio-recorded. The first author and an experienced bilingual note-taker were also present. Questionnaires were distributed to participants in paper format; this is also the method provided during baseline and follow-up visits for *Mi Vida Saludable*. In this study, Latina breast cancer survivors completed the questionnaire, and were then asked about the relevancy, ambiguity, and difficulty of items. Women were led through the questionnaire and were asked how they thought about the questions and whether any questions were unclear or confusing.

**Assessment of Internal Consistency Reliability and Test-Retest Reliability.**

***Recruitment of Study Participants for Validity and Reliability Assessments.*** The Columbia University Medical Center Institutional Review Board approved this study (IRB-AAAP0461). All participants provided written informed consent. Data for these analyses are from participants in the first three cohorts of the *Mi Vida Saludable* trial (n=104). Not all participants completed baseline measurements, which is why only n=95 have been randomized as of October 2017. Study participants were recruited from Columbia University Medical Center (CUMC) oncology outpatient clinics, via mailed and emailed letters to existing local breast

cancer patient databases, Avon Army of Women, community advertising, recruitment at other New York metropolitan area cancer centers and clinics, and attendance at cancer awareness events throughout New York City.

Potential participants were eligible if they were female, ≥21 years of age, self-identified as Hispanic/ Latina, and were able to speak English or Spanish. In addition, they had to self-identify as having a medical history of histologically-confirmed stage 0-III breast cancer with no evidence of metastatic disease, and being ≥90 days post final treatment including chemotherapy, biologic therapy, i.e. trastuzumab, radiation therapy, or breast surgery (current use of hormonal therapy permitted). Participants had to be willing and able to receive emails and text messages and/ or attend educational classes for the *Mi Vida Saludable* trial, depending on how they would be randomized, and to travel to CUMC for data collection. Participants were ineligible if they were smokers, or if had uncontrolled diabetes mellitus defined as HgbA1C >7%. There were also some behavioral inclusion criteria. First, participants needed to consume <5 serving of fruits and vegetables per day, measured by NIH Fruit and Vegetables Screener, which has been validated among Hispanic populations (Thompson et al., 2005). Second, participants needed to engage in <150 weekly minutes of moderate to vigorous physical activity, measured by two questions from the International Physical Activity Questionnaire (IPAQ) short form, which has also been previously validated in Hispanic populations (Ruiz-Casado et al., 2016).

Of those screened (n=504), only n=15 (3.0%) participants were excluded based on eating five or more servings of fruits and vegetable per day and/ or engaging in 150 minutes or more of weekly moderate to vigorous physical activity. In addition, n=36 (7.1%) were excluded because they did not have access to internet, email, or text messaging; n=45 (8.9%) had immediate health issues that required their time and attention; and n=4 (0.8%) were active smokers. Participants

received public transit travel reimbursement for data collection. After all baseline data were collected, participants were randomized into the *Mi Vida Saludable* trial.

***Assessment of Internal Consistency Reliability and Test-retest Reliability.*** Internal consistency reliability tests the homogeneity of the items within a scale that is intended to measure a single phenomenon, in this case *preferences* and *self-efficacy* (Hurley et al., 2013). Internal consistency was assessed at the first baseline visit, when the questionnaire was completed by all participants. Test-retest reliability measures the stability of an instrument at 2 time points (Hurley et al., 2013). Women were given the option to complete the questionnaire for test-retest reliability purposes and received an additional $25 gift card for their time and participation.

Data were collected during two separate in-person baseline sessions, 1-3 weeks apart. The second baseline clinic visit ("Baseline 2") was completed 2-3 weeks prior to the start of one section of the study intervention. A subsample of 30 participants completed the questionnaire at both baseline assessments within the first two cohorts. Participants completed the questionnaire in about 15-30 minutes.

***Statistical Analyses for Internal Consistency Reliability and Test-retest Reliability.*** Statistical analyses were performed using IBM SPSS Statistics, version 20 (SPSS Inc, Chicago, IL, 2012). Demographic and socioeconomic data were calculated for participants completing test-retest reliability and all participants (including those that did and did not complete test-retest reliability).

Internal consistency of each subscale was evaluated by calculating Cronbach's alpha and item-to-total correlations. A value >0.70 indicated sufficient internal consistency for each

subscale (Cronbach & Warrington, 1951). A Pearson correlation of more than 0.40 is desired to indicate good reliability of each item to the entire scale (Gandek et al., 1998).

Test-retest reliability of the questionnaire was assessed by calculating interclass correlation coefficients (ICC) and correlations between time 1 (T1) and time 2 (T2). The level of agreement of the ICC was categorized as follows: <0.2 = poor; 0.2-0.40 = fair; 0.41-0.60 = moderate; 0.61-0.80 = substantial; and >0.80 = excellent (Abanto et al., 2014).

*Reduction of Questions.* In addition to testing for validity and reliability, the current study also reduced the number of items in the initial questionnaire by half due to participant questionnaire fatigue. Items were grouped by type of activity (e.g. dancing) or food group (e.g. starchy vegetables). Items to be included in the shortened version of the questionnaire were selected within each group by identifying which items had a) relatively high item-total correlations, and b) low mean scores, so as to avoid a ceiling effect. The initial questionnaire is denoted "*The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*-104", or "PSEL-104", as it contained 104 questions. The second iteration where questions were eliminated is denoted as "PSEL-47"; 57 questions were eliminated. The third iteration is denoted as "PSEL-41" as another 6 questions were eliminated.

## 3.3 RESULTS

### 3.3.1 Content Validity by Expert Panel Review

Written and verbal feedback from experts was used to modify *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. Items that lacked relevance or clarity were removed or revised; suggestions regarding the inclusion of new items

were considered. Modifications focused on questionnaire layout, including the addition of pictures of fruits and vegetables participants may not be familiar with, e.g. winter squash, and the addition of examples of different food types high in fat and added sugar.

### 3.3.2 Face Validity by Cognitive Interviews

Participant demographics are shown in Table 3.1. Participants (n=4) were 58.3 mean years of age, mostly (75%) Dominican, and all had at least one member in their household participating in national food assistance programs: the Supplemental Nutrition Assistance Program (SNAP) or the Special Supplemental Program for Women, Infants, and Children (WIC). Most women (75%) had completed some or all of high school as their highest level of education. All participants had health insurance and were covered by Medicare and/ or Medicaid. Women were diagnosed with breast cancer an average of 6.6 years before the focus group.

**Table 3.1. Demographic, socioeconomic, and health characteristics of focus group participants**

| | **Face Validity** n=4 n (%) |
|---|---|
| **Age** | 58.3 |
| **National Background** | |
| Dominican | 3 (75%) |
| Cuban | 1 (25%) |
| **SNAP or WIC Participation** | |
| SNAP or WIC | 4 (100%) |
| **Highest Education Level** | |
| Some high school | 1 (25%) |
| High school graduate or GED | 2 (50%) |
| College degree | 1 (25%) |
| **Health Insurance** | |
| Insured | 4 (100%) |
| **Health Insurance Type** | |
| Medicaid | 4 (100%) |
| Medicare | 3 (75%) |
| **Breast Cancer Diagnosis** *time since diagnosis* | 6.6 years |
| **Breast Cancer Treatment** | |
| Received surgery | 4 (100%) |
| Received chemotherapy treatment | 2 (50%) |
| Received radiation treatment | 1 (25%) |

| | |
|---|---|
| Received hormone therapy | 3 (75%) |

Abbreviations: SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Program for Women, Infants, and Children

A bilingual team researcher reviewed the Spanish focus group transcript and the research team determined which changes to make to *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. Participants understood the questions, layout, and type of answer desired for *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. Participants felt the physical activity mediator questions were clear; there was evidence that participants understood the questions, as they explained the questions in their own words. They reported the layout and answer options were clear and did not have any suggestions for changes.

There was also no specific feedback on questions related to fruits and vegetables. For questions related to dietary fat, women wanted to include examples of alternative dairy sources, particularly almond milk, coconut milk, soymilk, and rice milk, which they drank more often than cow's milk. Women liked the combinations of animal proteins that helped them understand the types of food groupings we were aiming for (e.g. "chicken and turkey", and "salami or sausage"). Women also requested fish to be included as a low-fat animal protein example. Participants noted that they think about pork and beef very differently in terms of cooking preparation; wording was changed to "pork and/or beef". This separation of terms indicated that grouping pork and beef together was double-barreled. In addition, women requested "boiling" to be added as a low-fat cooking method. When discussing potatoes, women requested that "red potatoes" be specifically included as a baked option as these are commonly eaten. All of these changes were made to the questionnaire. For questions related to added sugar, some women

discussed adding brown sugar instead of white sugar to their beverages e.g. coffee and tea. The question was broadened to encompass "*any* kind of added sugar".

### 3.3.3 Demographic and Socioeconomic Characteristics of Participants Assessing Internal Consistency and Test-retest Reliability

Table 3.2 provides demographic information of the total sample (n=104) and those completing test-retest reliability (n=30). For the total sample and test-retest reliability sample respectively, mean age was 56.1 years and 53.4 years; most women were Hispanic/ Latina Black Caribbean (31.7%; 40.0%) or Hispanic/ Latina White Caribbean (21.2%; 36.7%) race, and were of Dominican descent (79.8%; 76.7%). Education levels were fairly evenly distributed, but the majority of participants earned a household income of less than $15,000. Both groups reported being moderately comfortable using the internet, email, and text messaging. Participants were more comfortable with Spanish than English for both groups ($\overline{x}$ =1.85 total sample, $\overline{x}$ =2.1 test-retest reliability sample).

**Table 3.2. Demographic and socioeconomic characteristics of participants in first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial completing measures to assess reliability of mediator questionnaire**

| Variable | n=104 | | n=30 | |
|---|---|---|---|---|
| **Age** | | | | |
| mean (SD) | 56.11 | 9.945 | 53.40 | 8.764 |
| missing | 0 | - | 0 | - |
| n (%) | | | | |
| <50 | 26 | 25.0% | 10 | 33.3% |
| 50-59 | 39 | 37.5% | 12 | 40.0% |
| 60+ | 39 | 37.5% | 8 | 26.7% |
| **Specific Hispanic Race/ Ethnicity, n (%)** | | | | |
| Black/ African American/ African descent | 0 | 0.0% | 0 | 0% |
| Central or South American | 14 | 13.5% | 3 | 10.0% |
| White Caribbean | 22 | 21.2% | 8 | 36.7% |
| Black Caribbean | 33 | 31.7% | 12 | 40.0% |
| Caribbean Indian or North American | 5 | 4.8% | 2 | 6.7% |

| | | | | |
|---|---|---|---|---|
| Other | 28 | 26.9% | 4 | 13.3% |
| Missing | 6 | 5.8% | 2 | 6.7% |
| **National Background, n (%)** | | | | |
| Argentinean | 1 | 1.0% | 0 | 0.0% |
| Columbian | 3 | 2.9% | 1 | 3.3% |
| Cuban | 1 | 1.0% | 0 | 0.0% |
| Dominican | 83 | 79.8% | 23 | 76.7% |
| Ecuadorian | 6 | 5.8% | 2 | 6.7% |
| Salvadorian | 1 | 1.0% | 0 | 0.0% |
| Mexican | 1 | 1.0% | 0 | 0.0% |
| Puerto Rican | 5 | 4.8% | 3 | 10.0% |
| Other | 4 | 3.8% | 3 | 10.0% |
| Missing | 1 | 1.0% | 0 | 0.0% |
| **Education, n (%)** | | | | |
| Less than high school | 29 | 27.9% | 5 | 16.7% |
| High school graduate or GED | 20 | 19.2% | 7 | 23.3% |
| Some college but not a graduate; Trade school; Technical school; or Associate degree | 29 | 27.9% | 9 | 30.0% |
| College degree; Master's or doctoral degrees | 24 | 23.1% | 8 | 26.7% |
| Missing | 2 | 1.9% | 1 | 3.3% |
| **Annual household income, n (%)** | | | | |
| $0 - $15,000 | 63 | 60.6% | 14 | 46.7% |
| $15,001 - $30,000 | 18 | 17.3% | 4 | 13.3% |
| $30,001 - $60,000 | 11 | 10.5% | 7 | 23.3% |
| $60,001 - $100,000 | 8 | 7.7% | 5 | 16.7% |
| Missing | 4 | 3.8% | 0 | 0.0% |
| **SNAP or WIC Participation, n (%)** | | | | |
| SNAP | 56 | 53.8% | 16 | 53.3% |
| WIC | 3 | 2.9% | 1 | 3.3% |
| Missing | 1 | 1.0% | 0 | 0.0% |
| **Received chemotherapy, n (%)** | | | | |
| Yes | 53 | 51.0% | 14 | 46.7% |
| No | 46 | 44.2% | 15 | 50.0% |
| Missing | 5 | 4.8% | 1 | 3.3% |
| **Received hormonal therapy, n (%)** | | | | |
| Yes | 50 | 48.1% | 14 | 46.7% |
| No | 52 | 50.0% | 16 | 53.3% |
| Missing | 2 | 1.9% | 0 | 0.0% |
| **Received radiation treatment, n (%)** | | | | |
| Yes | 57 | 54.8% | 17 | 56.7% |
| No | 44 | 42.3% | 13 | 43.3% |
| Missing | 3 | 2.9% | 0 | 0.0% |
| **Received surgery, n (%)** | | | | |
| Yes | 102 | 98.1% | 29 | 96.7% |
| No | 1 | 1.0% | 1 | 3.3% |
| Missing | 1 | 1.0% | 0 | 0.0% |

| | | | | |
|---|---|---|---|---|
| **Comfortable using technology[1], mean (SD)** | | | | |
| Comfortable using internet | 2.67 | 1.50 | 2.33 | 1.27 |
| Missing | 0 | - | 0 | - |
| Comfortable using email | 2.70 | 1.55 | 2.30 | 1.15 |
| Missing | 1 | 1.0% | 0 | - |
| Comfortable using text messaging | 2.27 | 1.30 | 1.93 | 0.87 |
| Missing | 2 | 1.9% | 0 | - |
| **Acculturation[2], mean (SD)** | 1.85 | 0.604 | 2.1 | 0.548 |
| Range | 1.0 – 3.2 | | 1.1 – 2.9 | |
| Missing | 0 | - | 0 | - |

Note: Abbreviations: SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Program for Women, Infants, and Children
1.Response options: 1= extremely comfortable; 2= very comfortable; 3= somewhat comfortable; 4= not very comfortable; 5= not at all comfortable; 6= does not use
2. Range of acculturation scores (1=Spanish only; 5=English only)

### 3.3.4 Internal Consistency Reliability

Final ranges of item-total correlations for complete scales and successive scale alterations are presented in Table 3.3. Individual item-total correlations for each item in the initial scales, along with mean scores for the total sample and the test-retest reliability sample are listed in Tables 3.4, 3.5, and 3.6. Data in these analyses are with total participants (n=104). Scales were reduced once for fruit and vegetable intake and physical activity behavior, and twice for dietary fat and added sugar behavior, to create parsimonious yet representative scales for future analyses with suitable internal consistency and test-retest reliability results. Updated item-total correlations for each item in refined scales are presented in Tables 3.7, 3.8, and 3.9.

**Table 3.3. Internal Consistency Reliability Measures of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*, n=104**

| | | PSEL-104 | | | PSEL-47 | | | PSEL-41 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Items** | **No. of items** | Range of Item-Total Correlation Coefficients | Cronbach α | **No. of items** | Range of Item-Total Correlation Coefficients | Cronbach α | **No. of items** | Range of Item-Total Correlation Coefficients | Cronbach α |
| Physical Activity | **Preferences[1]** Please indicate which types of physical activity you like to do. *E.g. Walking at a brisk pace for leisure* | 16 | 0.32 - 0.67 | 0.87 | 8 | 0.51 – 0.69 | 0.76 | NA | NA | NA |
| | **Self-efficacy[2]** How confident are you that you could | 9 | 0.56 - 0.72 | 0.86 | 5 | 0.68 – 0.73 | 0.81 | NA | NA | NA |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | participate in regular moderate to vigorous physical activity over the next month? *E.g. When you are a little tired* | | | | | | | | | |
| Fruit and Vegetable Intake | **Preferences**[1] For each of the fruits and vegetables listed below, how much do you like or dislike each type of fruit or vegetable? *E.g. Leeks* | 28 | 0.18 - 0.57 | 0.89 | 6 | 0.47 – 0.75 | 0.72 | NA | NA | NA |
| | **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Eat a healthy snack, like a fruit or a vegetable, when you're really hungry?* | 7 | 0.59 - 0.72 | 0.85 | 4 | 0.64 – 0.78 | 0.71 | NA | NA | NA |
| Dietary Fat Intake | **Preferences**[1] How much do you like or dislike each type of food or drink listed below? *E.g. Chicken or turkey slices* | 14 | 0.23 - 0.60 | 0.81 | 6 | 0.45 – 0.73 | 0.65 | 5 | 0.49 – 0.75 | 0.75 |
| | **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Choose chicken or turkey slices instead of salami, sausage, or ham?* | 14 | 0.34 - 0.69 | 0.86 | 6 | 0.24 – 0.69 | 0.71 | 5 | 0.55 – 0.77 | 0.73 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Added Sugar Intake | **Preferences**[1] How much do you like or dislike each type of food or drink listed below? *E.g. Coffee or tea without added sugar* | 8 | 0.12 - 0.53 | 0.57 | 6 | 0.35 – 0.64 | 0.51 | 4 | 0.51 – 0.76 | 0.57 |
| | **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Choose coffee or tea without added sugar instead of coffee or tea with added sugar?* | 8 | 0.52 - 0.75 | 0.80 | 6 | 0.62 – 0.79 | 0.76 | 4 | 0.63 – 0.76 | 0.69 |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident

## Table 3.4. Item-to-Total Correlations, Means, and Ranges of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Physical Activity and Fruit and Vegetable Intake, PSEL-104

| | Items | Item-Total Correlation Coefficient n=104 | Range n=104 | Mean (STD) n=104 | T1 Range n=30 | T1 Mean (STD) n=30 | T2 Range n=30 | T2 Mean (STD) n=30 |
|---|---|---|---|---|---|---|---|---|
| **PHYSICAL ACTIVITY**[1] | **Preferences**[2] *Please indicate which types of physical activity you like to do.* | | | | | | | |
| Walking | Walking at a brisk pace for leisure | 0.41** | 0-5 | 3.26 (1.32) | 0-5 | 3.47 (1.22) | 0-5 | 3.97 (1.30) |
| | Walking at a brisk pace to get from place to place | 0.56** | 0-5 | 3.21 (1.17) | 0-5 | 3.23 (1.04) | 2-5 | 4.07 (0.91) |
| | Walking very quickly and/ or uphill for leisure[4] | 0.55** | 0-5 | 2.83 (1.30) | 0-5 | 2.87 (1.36) | 0-5 | 3.52 (1.35) |
| | Walking very quickly and/ or uphill to get from place to place[4] | 0.52** | 0-4 | 2.79 (1.21) | 0-5 | 3.10 (1.16) | 0-5 | 3.67 (1.40) |
| Housework | Doing housework with moderate effort | 0.32** | 0-5 | 3.27 (1.10) | 0-5 | 3.07 (1.20) | 3-5 | 4.00 (0.66) |
| | Doing housework with vigorous effort[4] | 0.43** | 0-5 | 2.92 (1.07) | 0-5 | 3.00 (1.11) | 0-5 | 3.72 (1.10) |
| Biking | Biking using light to moderate effort for leisure | 0.63** | 0-5 | 1.77 (1.67) | 0-5 | 1.93 (1.68) | 0-5 | 2.56 (1.74) |
| | Bicycling using vigorous effort for leisure[4] | 0.64** | 0-5 | 1.73 (1.59) | 0-5 | 1.90 (1.72) | 0-5 | 2.41 (1.76) |
| | Biking using light to moderate effort to get from place to place | 0.66** | 0-5 | 1.84 (1.70) | 0-5 | 2.17 (1.69) | 0-5 | 2.48 (1.83) |
| | Biking using vigorous effort to get from place to place | 0.59** | 0-5 | 1.71 (1.60) | 0-5 | 1.79 (1.59) | 0-5 | 2.22 (1.72) |
| Dancing | Dancing in a group setting[4] | 0.50** | 0-5 | 3.29 | 0-5 | 3.70 | 0-5 | 4.21 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | (1.51) | | (1.56) | | (1.11) |
| | Dancing at home[4] | 0.45** | 0-5 | 3.37 | 1-5 | 3.47 | 3-5 | 4.46 |
| | | | | (1.30) | | (1.04) | | (0.63) |
| Gym | Doing moderate activities at the gym | 0.59** | 0-5 | 2.82 | 0-5 | 2.97 | 0-5 | 3.76 |
| | | | | (1.64) | | (1.69) | | (1.35) |
| | Doing vigorous activities at the gym[4] | 0.67** | 0-5 | 2.34 | 0-5 | 2.43 | 0-5 | 2.97 |
| | | | | (1.63) | | (1.70) | | (1.70) |
| Children | Playing with children with moderate effort | 0.49** | 0-4 | 3.12 | 0-5 | 3.13 | 1-5 | 4.00 |
| | | | | (1.28) | | (1.25) | | (0.91) |
| | Playing with children with vigorous effort[4] | 0.55** | 0-5 | 3.03 | 0-5 | 3.20 | 1-5 | 3.90 |
| | | | | (1.42) | | (1.40) | | (0.89) |
| | **Self-efficacy**[3] *How confident are you that you could participate in regular moderate to vigorous physical activity over the next month?* | | | | | | | |
| | When you are a little tired | 0.62** | 1-4 | 2.67 | 1-4 | 2.83 | 1-4 | 3.39 |
| | | | | (0.97) | | (1.09) | | (0.88) |
| | When you are in a bad mood or feeling depressed | 0.56** | 1-5 | 3.04 | 1-5 | 3.03 | 2-5 | 3.43 |
| | | | | (1.05) | | (1.02) | | (0.74) |
| | When you have to do it by yourself | 0.62** | 1-4 | 3.15 | 1-4 | 3.27 | 1-5 | 3.36 |
| | | | | (0.94) | | (0.87) | | (0.91) |
| | When it becomes boring | 0.64** | 1-4 | 2.85 | 1-4 | 3.00 | 1-5 | 3.25 |
| | | | | (0.95) | | (0.96) | | (1.01) |
| | When you can't notice any improvements in your fitness[4] | 0.72** | 1-4 | 3.10 | 1-4 | 3.07 | 1-4 | 3.38 |
| | | | | (0.93) | | (0.87) | | (0.86) |
| | When you have many other demands on your time[4] | 0.63** | 1-5 | 2.95 | 1-4 | 3.10 | 2-4 | 3.31 |
| | | | | (0.91) | | (0.89) | | (0.76) |
| | When you feel a little stiff or sore[4] | 0.66** | 1-5 | 2.77 | 1-5 | 2.87 | 1-5 | 3.07 |
| | | | | (0.99) | | (1.14) | | (1.08) |
| | When the weather is bad[4] | 0.63** | 1-5 | 2.65 | 1-5 | 2.73 | 1-4 | 3.15 |
| | | | | (1.01) | | (1.17) | | (0.95) |
| | When you have to get up early to do physical activity, even on weekends[4] | 0.64** | 1-5 | 3.08 | 1-5 | 3.30 | 1-5 | 3.27 |
| | | | | (1.09) | | (1.02) | | (1.08) |
| **FRUIT AND VEGETABLE INTAKE** | **Preferences**[2] *For each of the fruits and vegetables listed below, how much do you like or dislike each type of fruit or vegetable?* | | | | | | | |
| Other Vegetables | Leeks | 0.49** | 0-5 | 3.49 | 1-5 | 3.53 | 0-5 | 3.80 |
| | | | | (1.34) | | (1.07) | | (1.27) |
| | Avocado | 0.26** | 2-5 | 4.61 | 2-5 | 4.55 | 2-5 | 4.73 |
| | | | | (0.58) | | (0.69) | | (0.64) |
| | Scallions/ green onions | 0.50** | 0-5 | 3.85 | 1-5 | 3.97 | 0-5 | 4.30 |
| | | | | (1.16) | | (1.10) | | (1.02) |
| | Shallots | 0.47** | 0-5 | 3.79 | 0-5 | 3.63 | 0-5 | 3.69 |
| | | | | (1.51) | | (1.77) | | (1.58) |
| | Bell pepper | 0.44** | 0-5 | 4.30 | 0-5 | 4.30 | 0-5 | 4.23 |
| | | | | (0.95) | | (1.26) | | (1.25) |
| Fruit | Apples | 0.30** | 1-5 | 4.30 | 1-5 | 4.23 | 3-5 | 4.57 |
| | | | | (0.77) | | (0.86) | | (0.63) |
| Cruciferous Vegetables | Broccoli | 0.49** | 0-5 | 4.18 | 2-5 | 4.10 | 2-5 | 4.31 |
| | | | | (0.87) | | (0.85) | | (0.71) |
| | Cauliflower | 0.54** | 0-5 | 3.91 | 2-5 | 4.10 | 2-5 | 4.17 |
| | | | | (1.03) | | (0.71) | | (1.09) |
| | Green cabbage[4] | 0.55** | 0-5 | 3.97 | 0-5 | 3.87 | 3-5 | 4.33 |
| | | | | (1.11) | | (1.20) | | (0.84) |
| | Purple cabbage | 0.57** | 0-5 | 3.62 | 0-5 | 3.27 | 2-5 | 4.17 |
| | | | | (1.52) | | (1.98) | | (1.12) |
| | Brussels sprouts | 0.49** | 0-5 | 2.88 | 0-5 | 2.90 | 0-5 | 3.30 |
| | | | | (1.78) | | (1.69) | | (1.80) |
| Red and Orange Vegetables | Carrots | 0.32** | 1-5 | 4.23 | 1-5 | 3.93 | 0-5 | 4.47 |
| | | | | (0.74) | | (0.98) | | (0.63) |
| | Beets | 0.19 | 0-5 | 4.18 | 2-5 | 4.20 | 0-5 | 4.27 |
| | | | | (0.92) | | (0.76) | | (1.20) |
| | Tomatoes, tomato pasta, canned tomatoes[4] | 0.45** | 1-5 | 4.10 | 1-5 | 4.23 | 0-5 | 4.34 |
| | | | | (0.99) | | (0.90) | | (1.11) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Green Leafy Vegetables | Arugula | 0.47** | 0-5 | 3.02 (1.73) | 0-5 | 3.07 (1.82) | 2-5 | 3.55 (1.50) |
| | Mustard greens | 0.49** | 0-5 | 1.51 (1.86) | 0-5 | 1.47 (1.81) | 0-5 | 2.00 (1.88) |
| | Collard greens | 0.46** | 0-5 | 3.18 (1.69) | 0-5 | 3.07 (1.78) | 0-5 | 2.96 (1.77) |
| | Kale[4] | 0.57** | 0-5 | 3.16 (1.71) | 0-5 | 3.62 (1.45) | 2-5 | 3.41 (1.86) |
| | Spinach, baby spinach | 0.44** | 0-5 | 4.18 (0.94) | 3-5 | 4.40 (0.62) | 0-5 | 4.52 (0.57) |
| | Chard[4] | 0.53** | 0-5 | 1.97 (1.97) | 0-5 | 1.93 (2.03) | 0-5 | 2.17 (2.07) |
| Starchy Vegetables, Beans & Peas | Spaghetti squash[4] | 0.61** | 0-5 | 2.54 (2.07) | 0-5 | 2.57 (1.92) | 3-5 | 2.83 (2.01) |
| | Calabaza squash | 0.46** | 1-5 | 4.17 (0.88) | 1-5 | 4.13 (0.98) | 0-5 | 4.33 (0.96) |
| | Parsnips | 0.52** | 0-5 | 1.63 (1.85) | 0-5 | 1.77 (1.92) | 0-5 | 2.00 (2.07) |
| | Sweet potatoes | 0.29** | 0-5 | 4.16 (0.90) | 3-5 | 4.37 (0.56) | 1-5 | 4.45 (0.99) |
| | Turnips | 0.52** | 0-5 | 2.04 (1.93) | 0-5 | 1.67 (1.97) | 0-5 | 2.45 (2.20) |
| | Butternut squash[4] | 0.56** | 0-5 | 2.48 (1.96) | 0-5 | 2.30 (2.07) | 0-5 | 2.83 (2.22) |
| | Garbanzo beans (chickpeas) | 0.46** | 2-5 | 4.26 (0.76) | 2-5 | 4.23 (0.82) | 0-5 | 4.24 (1.22) |
| | Peas | 0.42** | 0-5 | 4.06 (0.95) | 2-5 | 4.14 (0.79) | 3-5 | 4.29 (0.90) |
| | **Self-efficacy**[3] *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | | | | | | | |
| | Eat a healthy snack, like a fruit or a vegetable, when you're really hungry?[4] | 0.59** | 1-5 | 3.89 (0.75) | 2-5 | 4.10 (0.66) | 3-5 | 4.30 (0.60) |
| | Eat healthy foods, like fruits or vegetables, when you are tired?[4] | 0.72** | 1-5 | 3.89 (0.71) | 3-5 | 4.13 (0.57) | 3-5 | 4.33 (0.55) |
| | Eat healthy foods, like fruits or vegetables, when there are junk foods in your house like chips, cookies, or candy? | 0.68** | 1-5 | 3.80 (0.87) | 2-5 | 3.90 (0.90) | 3-5 | 4.22 (0.85) |
| | Eat fruit instead of cake, cookies, candy, ice cream, or other sweets for dessert? | 0.70** | 2-5 | 3.78 (0.87) | 2-5 | 4.07 (0.79) | 3-5 | 4.13 (0.90) |
| | Eat fruits and vegetables when your family and friends are eating junk foods like chips, cookies, or candy?[4] | 0.60** | 1-5 | 3.76 (0.85) | 2-5 | 3.97 (0.77) | 3-5 | 4.23 (0.77) |
| | Buy or bring fruits and vegetables to eat at work? | 0.67** | 1-5 | 3.97 (0.79) | 3-5 | 4.15 (0.66) | 3-5 | 4.42 (0.58) |
| | Snack on fruits and vegetables rather than on junk foods while watching TV?[4] | 0.68** | 1-5 | 3.90 (0.79) | 1-5 | 4.07 (0.87) | 3-5 | 4.17 (0.79) |

Note

1. Directions included the following definitions: Moderate to vigorous physical activities refer to activities that take moderate to vigorous physical effort and make you breathe somewhat harder or much harder than normal. You may have a difficult time having conversations. Examples include walking briskly, running, carrying children upstairs or for distances, and doing housework like carrying grocery bags. "Regular" physical activity means 2 ½ hours (150 minutes) per week. If we think about it on a daily basis, it would be 20 minutes every day or 30 minutes 5 times per week.
2. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
3. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident
4. Included in PSEL-47

*p<0.05 (2-tailed)

**p<0.01 (2-tailed)

## Table 3.5. Item-to-Total Correlations of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Physical Activity and Fruit and Vegetable Intake, PSEL-47, n=104

| | Items | No. of items | Item-Total Correlation Coefficient n=104 |
|---|---|---|---|
| **Physical Activity**[1] | **Preferences**[2] | 8 | |
| | *Please indicate which types of physical activity you like to do.* | | |
| | Walking very quickly and/ or uphill for leisure | | 0.68** |
| | Walking very quickly and/ or uphill to get from place to place | | 0.69** |
| | Doing housework with vigorous effort | | 0.55** |
| | Bicycling using vigorous effort for leisure | | 0.51** |
| | Dancing in a group setting | | 0.66** |
| | Dancing at home | | 0.61** |
| | Doing vigorous activities at the gym | | 0.65** |
| | Playing with children with vigorous effort | | 0.62** |
| | **Self-efficacy**[3] | 5 | |
| | *How confident are you that you could participate in regular moderate to vigorous physical activity over the next month?* | | |
| | When you can't notice any improvements in your fitness | | 0.73** |
| | When you have many other demands on your time | | 0.68** |
| | When you feel a little stiff or sore | | 0.73** |
| | When the weather is bad | | 0.73** |
| | When you have to get up early to do physical activity, even on weekends | | 0.69** |
| **Fruit and Vegetable Intake** | **Preferences**[2] | 6 | |
| | *For each of the fruits and vegetables listed below, how much do you like or dislike each type of fruit or vegetable?* | | |
| | Green cabbage | | 0.47** |
| | Spaghetti squash | | 0.70** |
| | Kale | | 0.70** |
| | Tomatoes, tomato paste, canned tomatoes | | 0.51** |
| | Butternut squash | | 0.69** |
| | Chard | | 0.75** |
| | **Self-efficacy**[3] | 4 | |
| | *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | | |
| | Eat a healthy snack, like a fruit or a vegetable, when you're really hungry? | | 0.64** |
| | Eat healthy foods, like fruits or vegetables, when you are tired? | | 0.78** |
| | Eat fruits and vegetables when your family and friends are eating junk foods like chips, cookies, or candy? | | 0.65** |
| | Snack on fruits and vegetables rather than on junk foods while watching TV? | | 0.65** |

Note

1. Directions included the following definitions: Moderate to vigorous physical activities refer to activities that take moderate to vigorous physical effort and make you breathe somewhat harder or much harder than normal. You may have a difficult time having conversations. Examples include walking briskly, running, carrying children upstairs or for distances, and doing housework like carrying grocery bags. "Regular" physical activity means 2 ½ hours (150 minutes) per week. If we think about it on a daily basis, it would be 20 minutes every day or 30 minutes 5 times per week.

1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like

2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident

*p<0.05 (2-tailed)

**p<0.01 (2-tailed)

## Table 3.6. Preferences Item-to-Total Correlations, Means, and Ranges of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Dietary Fat and Added Sugar Intake, PSEL-104

| | Items | Item-to-Total Correlation Coefficient | Range n=104 | Mean n=104 | T1 Range n=30 | T1 Mean n=30 | T2 Range n=30 | T2 Mean n=30 |
|---|---|---|---|---|---|---|---|---|
| **Dietary Fat Intake** | **Preferences**[1] *How much do you like or dislike each type of food or drink listed below?* | | | | | | | |
| Low Fat Meat | Chicken or turkey slices | 0.44** | 0-5 | 3.94 | 0-5 | 3.97 | 2-5 | 4.47 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | (0.96) | | (1.03) | | (0.68) |
| | 90% or 95% lean ground meat or turkey[3,4] | 0.58** | 0-5 | 3.42 (1.12) | 0-5 | 3.57 (1.32) | 1.5 | 3.97 (1.16) |
| | Chicken without the skin | 0.60** | 0-5 | 4.11 (0.82) | 0-5 | 4.20 (1.03) | 4-5 | 4.53 (0.51) |
| | Turkey burgers or veggie burgers[3] | 0.49** | 0-5 | 2.95 (1.54) | 0-5 | 2.87 (1.63) | 0-5 | 3.41 (1.52) |
| | Pork and/ or beef without visible (white) fat[4] | 0.47** | 0-5 | 3.20 (1.21) | 0-5 | 3.23 (1.43) | 1-5 | 3.30 (1.24) |
| Low Fat dairy/ Low Amounts of High Fat Dairy | Low-fat 1% or non-fat skim milks (cow, almond, soy, rice) | 0.36** | 0-5 | 3.68 (1.02) | 0-5 | 3.60 (1.25) | 1-5 | 4.13 (0.86) |
| | Low-fat or non-fat yogurt | 0.42** | 0-5 | 3.59 (1.09) | 0-5 | 3.53 (1.25) | 0-5 | 3.80 (1.10) |
| | Foods made with a small amount of cheese[3] | 0.43** | 1-5 | 3.72 (0.82) | 2-5 | 3.83 (0.91) | 0-5 | 3.83 (1.05) |
| Low Fat Potatoes/ Starches | Baked (not regular, friend) plantain or potato chips | 0.23** | 0-5 | 3.54 (0.95) | 0-5 | 3.48 (1.12) | 1-5 | 3.53 (1.14) |
| | Baked (not fried) plantains or potatoes (white, red, sweet)[3,4] | 0.51** | 0-5 | 3.84 (0.87) | 0-5 | 3.79 (1.26) | 0-5 | 3.83 (1.09) |
| Low Fat Cooking Methods | Chicken that is roasted, baked, broiled, boiled, or grilled[3,4] | 0.53** | 0-5 | 3.96 (0.86) | 0-5 | 4.03 (0.96) | 4-5 | 4.53 (0.51) |
| | Fish that is baked, broiled, or grilled | 0.54** | 0-5 | 4.06 (0.97) | 0-5 | 3.97 (1.38) | 0-5 | 4.27 (1.26) |
| | Foods made with oil instead of butter or lard[3,4] | 0.56** | 0-5 | 3.38 (1.05) | 0-5 | 3.30 (1.24) | 0-5 | 3.57 (1.19) |
| | Foods made with small amounts of fat | 0.59** | 0-5 | 3.93 (0.74) | 0-5 | 3.90 (0.96) | 0-5 | 4.00 (1.08) |
| **Added Sugar Intake** | **Preferences**[1] *How much do you like or dislike each type of food or drink listed below?* | | | | | | | |
| Beverages | Coffee or tea without added sugar | 0.12 | 0-5 | 2.83 (1.23) | 1-5 | 2.70 (1.37) | 1-5 | 3.20 (1.24) |
| | Water, sparkling water, or water mixed with slices of fruits or vegetables[3,4] | 0.53** | 1-5 | 3.95 (0.87) | 1-5 | 3.93 (1.11) | 0-5 | 3.90 (1.16) |
| Cereal | Hot cereal without any type of added sugar like plain oatmeal or plain cream of wheat[3] | 0.17 | 0-5 | 3.40 (1.11) | 1-5 | 3.27 (1.02) | 1-5 | 3.57 (1.17) |
| | Cold cereal without any type of added sugar like regular Cheerios | 0.15 | 0-5 | 3.39 (1.09) | 0-5 | 3.37 (1.10) | 0-5 | 3.43 (1.28) |
| Dessert | Fresh or frozen fruit as a sweet, treat, or dessert[3,4] | 0.43** | 1-5 | 3.56 (0.95) | 1-5 | 3.57 (1.10) | 0-5 | 3.87 (1.20) |
| Dairy | Plain yogurt (with or without adding fruit yourself) or "light" yogurt[3] | 0.14 | 1-5 | 3.44 (1.02) | 1-5 | 3.30 (1.12) | 2-5 | 3.77 (1.01) |
| | Plain, unsweetened milks (cow, almond, soy, rice)[3,4] | 0.37** | 0-5 | 3.62 (1.02) | 1-5 | 3.57 (1.19) | 0-5 | 3.83 (1.18) |
| Other | Salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself[3,4] | 0.53** | 1-5 | 3.64 (0.96) | 1-5 | 3.57 (1.17) | 0-5 | 3.70 (1.09) |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident
3. Included in PSEL-47
4. Included in PSEL-41
*p<0.01 (2-tailed)

**Table 3.7. Self-efficacy Item-to-Total Correlations, Means, and Ranges of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Dietary Fat and Added Sugar Intake, PSEL-104**

| | Items | Item-to-Total Correlation Coefficient | Range n=104 | Mean n=104 | T1 Range n=30 | T1 Mean n=30 | T2 Range n=30 | T2 Mean n=30 |
|---|---|---|---|---|---|---|---|---|
| **DIETARY FAT INTAKE** | **Self-efficacy**[2] *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | | | | | | | |
| LOW FAT MEAT | Choose chicken or turkey slices instead of salami, sausage, or ham? | 0.62** | 1-5 | 3.96 (0.76) | 2-5 | 4.23 (0.68) | 2-5 | 4.33 (0.71) |
| | Choose 90% or 95% lean ground meat or turkey instead of less lean, 75% to 85% lean, ground meat or turkey?[3,4] | 0.63** | 1-5 | 3.75 (1.01) | 1-5 | 3.87 (1.20) | 3-5 | 4.36 (0.56) |
| | Choose to eat chicken without the skin instead of chicken with its skin? | 0.64** | 1-5 | 4.04 (0.68) | 3-5 | 4.27 (0.64) | 3-5 | 4.53 (5.71) |
| | Choose turkey burgers or veggie burgers instead of hamburgers or cheeseburgers?[3] | 0.54** | 1-5 | 3.66 (1.05) | 1-5 | 3.90 (1.13) | 1-5 | 4.14 (0.93) |
| | Choose pork and/or beef without visible (white) fat instead of pork and/or beef with visible fat?[4] | 0.60** | 1-5 | 3.75 (1.02) | 1-5 | 4.10 (1.03) | 1-5 | 4.10 (0.94) |
| LOW FAT DAIRY/ LOW AMOUNTS OF HIGH FAT DAIRY | Choose low-fat 1% or non-fat skim milks (cow, almond, soy, rice) instead of cream or 2% or whole milks? | 0.34** | 1-5 | 3.72 (0.98) | 1-5 | 3.70 (1.18) | 2-5 | 4.24 (0.74) |
| | Choose low-fat or non-fat yogurt instead of regular fat yogurt, sour cream, or whipped cream? | 0.55** | 1-5 | 3.71 (1.01) | 1-5 | 4.00 (0.98) | 2-5 | 4.17 (0.81) |
| | Choose foods made with a small amount of cheese instead of foods with a lot of cheese?[3] | 0.57** | 1-5 | 3.91 (0.82) | 1-5 | 4.07 (0.98) | 2-5 | 4.13 (0.86) |
| STARCHY VEGETABLES | Choose baked (not regular, fried) plantain or potato chips instead of regular plantain or potato chips? | 0.47** | 1-5 | 3.92 (0.67) | 1-5 | 4.00 (0.87) | 2-5 | 4.20 (0.66) |
| | Choose baked (not fried) plantains or potatoes (white, red, sweet) instead of fried plantains, hash browns, or French fries?[3,4] | 0.68** | 1-5 | 4.06 (0.61) | 2-5 | 4.23 (0.77) | 2-5 | 4.13 (0.86) |
| LOW FAT COOKING METHODS | Choose chicken that is roasted, baked, broiled, boiled, or grilled instead of fried chicken?[3,4] | 0.69** | 1-5 | 4.06 (0.67) | 2-5 | 4.27 (0.69) | 3-5 | 4.43 (0.57) |
| | Choose fish that is baked, broiled, or grilled instead of fried fish? | 0.64** | 1-5 | 4.01 (0.81) | 1-5 | 4.13 (1.11) | 1-5 | 4.33 (0.84) |
| | Choose foods cooked with oil instead of butter or lard?[3,4] | 0.46** | 1-5 | 3.73 (1.01) | 1-5 | 4.00 (1.02) | 2-5 | 4.23 (0.73) |
| | Choose foods made with small amounts of fat instead of foods made with a lot of fat? | 0.59** | 1-5 | 4.12 (0.65) | 1-5 | 4.27 (0.87) | 2-5 | 4.27 (0.74) |
| **Added Sugar Intake** | **Self-efficacy**[2] *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | | | | | | | |
| BEVERAGES | Choose coffee or tea without added sugar instead of coffee or tea with added sugar? | 0.54** | 1-5 | 3.10 (1.22) | 1-5 | 2.97 (1.38) | 1-5 | 3.27 (1.36) |
| | Choose water, sparkling water, or water mixed with slices of fruits or vegetables instead of drinks with added sugar such as flavored waters, sodas, juices, or energy drinks?[3,4] | 0.52** | 1-5 | 4.06 (0.72) | 1-5 | 4.24 (0.87) | 2-5 | 4.10 (0.89) |
| CEREAL | Choose hot cereal without any type of | 0.66** | 1-5 | 3.50 | 1-5 | 3.37 | 1-5 | 3.34 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | added sugar like plain oatmeal or plain cream of wheat instead of hot cereal with added sugar like Maple and Brown Sugar Oatmeal, Cream of Wheat with added sugar?[3] | | | (1.04) | | (1.38) | | (1.26) |
| | Choose cold cereal without any type of added sugar like regular Cheerios instead of cold cereal with added sugar like Honey Nut Cheerios, Special K with Berries, Granola? | 0.66** | 1-5 | 3.64 (0.98) | 1-5 | 3.67 (1.24) | 1-5 | 3.54 (1.07) |
| DESSERT | Choose fresh or frozen fruit as a sweet, treat, or dessert instead of cookies, candy, cakes, or pastries?[3,4] | 0.57** | 1-5 | 3.83 (0.79) | 1-5 | 3.90 (0.96) | 3-5 | 4.17 (0.66) |
| DAIRY | Choose plain yogurt (with or without adding fruit) or "light" yogurt instead of ice cream, yogurt with more added sugar, milkshakes?[3] | 0.75** | 1-5 | 3.65 (0.91) | 1-5 | 3.57 (1.10) | 2-5 | 4.00 (0.86) |
| | Plain, unsweetened, milks (cow, almond, soy, rice) instead of drinks with added sugar such as chocolate or vanilla milks, flavored waters, sodas, juices, or energy drinks?[3,4] | 0.66** | 1-5 | 3.75 (0.93) | 1-5 | 3.86 (1.09) | 1-5 | 3.83 (1.14) |
| OTHER | Choose salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself instead of salad dressings and sauces with higher amounts of added sugar?[3,4] | 0.53** | 1-5 | 3.82 (0.89) | 1-5 | 3.80 (1.10) | 3-5 | 4.18 (0.72) |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident
3. Included in PSEL-47
4. Included in PSEL-41
*p<0.01 (2-tailed)

## Table 3.8. Preferences & Self-efficacy Item-to-Total Correlations of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Dietary Fat and Added Sugar Intake, PSEL-47

| | Items | No. Items | Item-to-Total Correlation Coefficient | Items | No. Items | Item-to-Total Correlation Coefficient |
|---|---|---|---|---|---|---|
| **Dietary Fat Intake** | **Preferences**[1] *How much do you like or dislike each type of food or drink listed below?* | 6 | | **Self-efficacy**[2] *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | 6 | |
| | 90% or 95% lean ground meat or turkey | | 0.71** | Choose 90% or 95% lean ground meat or turkey instead of less lean, 75% to 85% lean, ground meat or turkey? | | 0.69** |
| | Foods made with a small amount of cheese | | 0.45** | Choose foods made with a small amount of cheese instead of foods with a lot of cheese? | | 0.24 |
| | Baked (not fried) plantains or potatoes (white, red, sweet) | | 0.56** | Choose baked (not fried) plantains or potatoes (white, red, sweet) instead of fried plantains, hash browns, or French fries? | | 0.47** |
| | Chicken that is roasted, baked, broiled, boiled, or grilled | | 0.58** | Choose chicken that is roasted, baked, broiled, boiled, or grilled instead of fried chicken? | | 0.53** |
| | Turkey burgers or veggie burgers | | 0.63** | Choose turkey burgers or veggie burgers instead of hamburgers or cheeseburgers? | | 0.31 |
| | Foods made with oil instead of butter or lard | | 0.73** | Choose foods cooked with oil instead of butter or lard? | | 0.67** |
| **Added Sugar** | **Preferences**[1] *How much do you like or* | 6 | | **Self-efficacy**[2] *Assuming that you want to, how confident* | 6 | |

| | | | | | |
|---|---|---|---|---|---|
| **Intake** | *dislike each type of food or drink listed below?* | | | *are you that you could do each of the following starting this week and continuing for at least 1 month?* | |
| | Water, sparkling water, or water mixed with slices of fruits or vegetables | 0.59** | | Choose water, sparkling water, or water mixed with slices of fruits or vegetables instead of drinks with added sugar such as flavored waters, sodas, juices, or energy drinks? | 0.63** |
| | Hot cereal without any type of added sugar like plain oatmeal or plain cream of wheat | 0.35** | | Choose hot cereal without any type of added sugar like plain oatmeal or plain cream of wheat instead of hot cereal with added sugar like Maple and Brown Sugar Oatmeal, Cream of Wheat with added sugar? | 0.63** |
| | Fresh or frozen fruit as a sweet, treat, or dessert | 0.51** | | Choose fresh or frozen fruit as a sweet, treat, or dessert instead of cookies, candy, cakes, or pastries? | 0.70** |
| | Plain yogurt (with or without adding fruit yourself) or "light" yogurt | 0.64** | | Choose plain yogurt (with or without adding fruit) or "light" yogurt instead of ice cream, yogurt with more added sugar, milkshakes? | 0.79** |
| | Plain, unsweetened milks (cow, almond, soy, rice) | 0.59** | | Choose plain, unsweetened milks (cow, almond, soy, rice) instead of drinks with added sugars such as chocolate or vanilla milks, flavored waters, sodas, juices, or energy drinks? | 0.71** |
| | Salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself | 0.60** | | Choose salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself instead of salad dressings and sauces with higher amounts of added sugar? | 0.62** |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident
*p<0.01 (2-tailed)

## Table 3.9. Preferences & Self-efficacy Item-to-Total Correlations of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas:* Dietary Fat and Added Sugar Intake, PSEL-41

| | **Items** | **No. Items** | **Item-to-Total Correlation Coefficient** | **Items** | **No. Items** | **Item-to-Total Correlation Coefficient** |
|---|---|---|---|---|---|---|
| **Dietary Fat Intake** | **Preferences**[1] *How much do you like or dislike each type of food or drink listed below?* | 5 | | **Self-efficacy**[2] *Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?* | 5 | |
| | 90% or 95% lean ground meat or turkey | | 0.70** | Choose 90% or 95% lean ground meat or turkey instead of less lean, 75% to 85% lean, ground meat or turkey? | | 0.77** |
| | Pork and/or beef without visible (white) fat | | 0.75** | Choose pork and/or beef without visible (white) fat instead of pork and/or beef with visible fat? | | 0.77** |
| | Baked (not fried) plantains or potatoes (white, red, sweet) | | 0.69** | Choose baked (not fried) plantains or potatoes (white, red, sweet) instead of fried plantains, hash browns, or French fries? | | 0.55** |
| | Chicken that is roasted, baked, broiled, boiled, or grilled | | 0.49** | Choose chicken that is roasted, baked, broiled, boiled, or grilled instead of fried chicken? | | 0.59** |
| | Foods made with oil instead of butter or lard | | 0.66** | Choose foods cooked with oil instead of butter or lard? | | 0.63** |
| **Added Sugar Intake** | **Preferences**[1] *How much do you like or dislike each type of food or* | 4 | | **Self-efficacy**[2] *Assuming that you want to, how confident are you that you could do* | 4 | |

| | | | |
|---|---|---|---|
| *drink listed below?* | | *each of the following starting this week and continuing for at least 1 month?* | |
| Water, sparkling water, or water mixed with slices of fruits or vegetables | 0.74** | Choose water, sparkling water, or water mixed with slices of fruits or vegetables instead of drinks with added sugar such as flavored waters, sodas, juices, or energy drinks? | 0.67** |
| Fresh or frozen fruit as a sweet, treat, or dessert | 0.52** | Choose fresh or frozen fruit as a sweet, treat, or dessert instead of cookies, candy, cakes, or pastries? | 0.76** |
| Plain, unsweetened milks (cow, almond, soy, rice) | 0.51** | Choose plain, unsweetened milks (cow, almond, soy, rice) instead of drinks with added sugars such as chocolate or vanilla milks, flavored waters, sodas, juices, or energy drinks? | 0.65** |
| Salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself | 0.76** | Choose salad dressings and sauces (such as tomato sauce) with low amounts of added sugar or that you make yourself instead of salad dressings and sauces with higher amounts of added sugar? | 0.63** |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident
*p<0.01 (2-tailed)

Initially, item-total correlations for the *Preferences* scale of physical activity ranged from 0.32 – 0.67 in the PSEL-104. By only including eight items which had the highest item-total correlations, relatively low mean scores, and were representative of the major physical activity categories, the range of item-total correlations increased to 0.51 – 0.69 in the PSEL-47. Cronbach alpha naturally increases with greater numbers of individual scale items (Bolarinwa, 2015; Tavakol & Dennick, 2011). Cronbach alpha decreased slightly from 0.87 to 0.76 in PSEL-47, but this value is still considered to represent sufficient reliability (Cronbach & Warrington, 1951). Similar results were seen for the *Self-efficacy* scale for physical activity, where item-total correlations increased from 0.56 – 0.72 to 0.68 – 0.73, and Cronbach alpha only decreased slightly from 0.86 to 0.81 in the PSEL-47. The total number of questions decreased from 16 to 8 in the *Preferences* scale, and 9 to 5 in the *Self-efficacy* scale in the PSEL-47.

*Preferences* and *Self-efficacy* scales for fruit and vegetable intake performed similarly to those of physical activity. Item-total correlations increased from 0.18 – 0.57 to 0.47 – 0.75 for the *Preferences* scale, and 0.59 – 0.72 to 0.64 – 0.78 for the *Self-efficacy* scale in the PSEL-47.

Cronbach alpha decreased slightly from 0.89 to 0.72 and from 0.85 to 0.71 for the *Preferences* and *Self-efficacy* scales, respectively. The total number of questions decreased from 28 to 6 for the *Preferences* scale, and from 7 to 4 for the *Self-efficacy* scale of the PSEL-47.

Dietary fat and added sugar scales were jointly developed, e.g. a *Preferences* question included "How much do you like chicken and turkey slices?" and the corresponding *Self-efficacy* question was "How confident are you that you could eat chicken and turkey slices instead of salami, sausage, or ham?". When removing questions therefore, corresponding questions were removed simultaneously from both the *Preferences* and *Self-efficacy* scales. Since item-total correlations were not all above 0.4, a second reduction was completed, from PSEL-47 to PSEL-41.

For the two iterations assessing mediators of dietary fat, item-total correlations increased from 0.23 – 0.60, to 0.45 – 0.73, to 0.49 – 0.75 for the *Preferences* scale, and increased from 0.34 – 0.69, to 0.24 – 0.69, to 0.55 – 0.77 for the *Self-efficacy* scale from the PSEL-104, PSEL-47, and PSEL-41, respectively. Cronbach alpha decreased from 0.81, to 0.65, and then increased to 0.75 for the *Preferences* scale; a similar pattern was seen with the *Self-efficacy* scale, from 0.86, to 0.71, to 0.73 in the three PSEL iterations.

Added sugar intake scales followed a similar pattern. Item-total correlations increased from 0.12 – 0.53 to 0.51 – 0.76 after the second modification, PSEL-41, for the *Preferences* scale, and increased from 0.52 – 0.75 to 0.63 – 0.76 for the *Self-efficacy* scale. Cronbach alpha remained the same for the *Preferences* scale, and decreased slightly from 0.80 to 0.69 for the *Self-efficacy* scale.

### 3.3.5 Test-retest Reliability

Summary outcomes of test-retest reliability are presented in Table 3.10. Data in these analyses are with participants who completed the measures a second time (n=30). For shortened physical activity PSEL *Preferences* scales, the test-retest reliability correlation was 0.61, and the ICC value was 0.65 (p=0.001); for the *Self-efficacy* scales, test-retest reliability correlation was 0.32, and the ICC value was 0.48 (p=0.04). For shortened fruit & vegetable PSEL *Preferences* scales, the test-retest correlation was 0.65 and the ICC value was 0.79 (p<0.001); for the *Self-efficacy* scales, the test-retest correlation was 0.43, and the ICC was 0.56 (0.01).

**Table 3.10. Test-Retest Reliability Measures of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*, n=30**

| | | PSEL-104 | | | | PSEL-47 | | | | PSEL-41 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Items** | No. of items | Correlation (between T1 and T2) Coefficient | Intraclass Correlation Coefficient (95% CI) | p-value | No. of items | Correlation (between T1 and T2) Coefficient | Intraclass Correlation Coefficient (95% CI) | p-value | No. of items | Correlation (between T1 and T2) Coefficient | Intraclass Correlation Coefficient (95% CI) | p-value |
| Physical Activity | **Preferences**[1] Please indicate which types of physical activity you like to do. *E.g. Walking at a brisk pace for leisure* | 16 | 0.28 | 0.35 (-0.19 – 0.67) | 0.06 | 8 | 0.61** | 0.65 (-0.02 – 0.87) | 0.001 | NA | NA | NA | NA |
| | **Self-efficacy**[2] How confident are you that you could participate in regular moderate to vigorous physical activity over the next month? *E.g. When you are a little tired* | 9 | 0.40* | 0.54 (0.08 – 0.78) | 0.01 | 5 | 0.32 | 0.48 (-0.08 – 0.75) | 0.04 | NA | NA | NA | NA |
| Fruit and Vegetable Intake | **Preferences**[1] For each of the fruits and vegetables | 28 | 0.54** | 0.65 (0.24 – 0.84) | 0.001 | 6 | 0.65** | 0.79 (0.54 – 0.90) | <0.001 | NA | NA | NA | NA |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | listed below, how much do you like or dislike each type of fruit or vegetable? *E.g. Leeks* | | | | | | | | | | | | |
| | **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Eat a healthy snack, like a fruit or a vegetable, when you're really hungry?* | 7 | 0.41* | 0.56 (0.11 – 0.79) | 0.01 | 4 | 0.43* | 0.56 (0.11 – 0.79) | 0.01 | NA | NA | NA | NA |
| Dietary Fat Intake | **Preferences**[1] How much do you like or dislike each type of food or drink listed below? *E.g. Chicken or turkey slices* | 14 | 0.07 | 0.11 (-0.77 – 0.56) | 0.37 | 6 | 0.13 | 0.21 (-0.61 – 0.62) | 0.26 | 5 | -0.03 | -0.06 (-1.19 – 0.49) | 0.57 |
| | **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Choose chicken or turkey slices instead of salami, sausage, or ham?* | 14 | 0.66** | 0.78 (0.54 – 0.89) | <0.001 | 6 | 0.64** | 0.77 (0.51 – 0.89) | <0.001 | 5 | 0.47** | 0.62 (0.22 – 0.82) | 0.01 |
| Added Sugar Intake | **Preferences**[1] How much do you like | 8 | 0.03 | 0.06 (-0.97 – 0.55) | 0.44 | 6 | 0.32 | 0.46 (-0.08 – 0.74) | 0.04 | 4 | 0.26 | 0.42 (-0.26 – 0.72) | 0.08 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| or dislike each type of food or drink listed below? *E.g. Coffee or tea without added sugar* | | | | | | | | | | | | |
| **Self-efficacy**[2] Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month? *E.g. Choose coffee or tea without added sugar instead of coffee or tea with added sugar?* | 8 | 0.51** | 0.67 (0.32 – 0.84) | 0.002 | 6 | 0.50* | 0.66 (0.20 – 0.85) | 0.008 | 4 | 0.45* | 0.62 (0.21 – 0.82) | 0.006 |

Note
1. Response options: 0= Never tried it; 1=Strongly dislike; 2=Dislike; 3=Neutral; 4=Like; 5=Strongly like
2. Response options: 1=Not at all confident; 2=Not very confident; 3=Neutral, 4=Very confident, 5=Extremely confident

For the PSEL-47 and PSEL-41 reduced scales, respectively, test-retest correlations were 0.13 and -0.03 for the Dietary Fat *Preferences* scale and 0.64 and 0.47 for Dietary Fat *Self-efficacy* scale. For the PSEL-47 and PSEL-41 reduced scales, respectively, test-retest correlations were 0.32 and 0.26 for Added Sugar *Preferences* scale; and 0.50 and 0.45 for the Added Sugar *Self-efficacy* scale.

For the PSEL-47 and PSEL-41 reduced scales, respectively, ICC scores were 0.21 (p=0.26) and -0.06 (p=0.57) for the Dietary Fat *Preferences* scale, and 0.77 (<0.001) and 0.62 (p=0.005) for the Dietary Fat *Self-efficacy* scale. For the PSEL-47 and PSEL-41 reduced scales, respectively, ICC scores were 0.46 (p=0.04) and 0.42 (p=0.08) for the Added Sugar *Preferences* scale; and 0.66 (p=0.008) and 0.62 (p=0.006) for the Added Sugar *Self-efficacy* scale.

## 3.4 DISCUSSION

Given that dietary and physical activity behaviors among breast cancer survivors are not meeting national recommendations (Blanchard et al., 2008; LeMasters et al., 2014; Milliron et al., 2014), evaluating the psychosocial mediators of their behavior is critically important in order to accurately determine what type of behavioral intervention is most effective at changing these lifestyle risk-factors (Blanchard et al., 2008; LeMasters et al., 2014; Milliron et al., 2014). To date, few studies have assessed potential mediators of lifestyle behaviors in Hispanic breast cancer survivors. The aim of this study was to develop and evaluate *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. In this study, we developed a questionnaire to assess *Preferences* and *Self-efficacy,* for each of the following behaviors: physical activity, fruit and vegetable intake, and dietary fat and added sugar intake. We determined content and face validity, used cognitive interviews, and examined internal consistency reliability and test-retest reliability of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas.* Findings revealed satisfactory reliability and validity properties for the questionnaire.

Content and face validity, and cognitive interviews successfully improved the questionnaire before quantitative analysis. Modifications from content and face validity included the addition of pictures of fruits and vegetables and the addition of examples of different food types high in fat and added sugar. Results from the cognitive interviews indicated primarily that changes to examples of foods with and without dietary fat and added sugar in the questionnaire should be made.

In order to shorten the questionnaire due to participant fatigue, an additional aim of process in this questionnaire's development was to reduce the number of questions in each scale. Two reduced forms of the questionnaire were created; items were selected if they had relatively high item-total correlations, and low mean scores, to avoid a ceiling effect. The first iteration eliminated 57 questions, PSEL-47, and the second iteration eliminated another six questions, PSEL-41. In total, about half of the items in each scale were eliminated; final scales, the to be used for the *Mi Vida Saludable* study comprised 45.2% of the original questions (47 vs. 104 total items). The initial questionnaire took 15 to 30 minutes to complete; the final questionnaire takes about 10 minutes to complete. Based on the results of the statistical tests, it is recommended that the PSEL-47 be used in further analyses for the *Mi Vida Saludable* study, as specific targeted food categories within the *Mi Vida Saludable* intervention are included in this version. PSEL-41 is described here for use in other studies, as their results for dietary fat and added sugar are marginally superior.

A Cronbach alpha value of >0.70 indicates sufficient internal consistency reliability (Cronbach & Warrington, 1951), and a Pearson correlation of >0.40 indicate good reliability of each item to the entire scale (Gandek et al., 1998). Study findings revealed that Cronbach alpha values were above 0.7 for all *Preferences* and *Self-efficacy* reduced scales except for *Preferences* for Added Sugar Intake (0.57). Study findings also revealed that item-total correlations were above 0.4 for all reduced *Preferences* and *Self-efficacy* scales. A value of 0.41 or greater ICC indicates at least moderate test-retest reliability (Abanto et al., 2014). Study findings revealed that ICC values were above 0.41 for all *Preferences* and *Self-efficacy* reduced scales except for *Preferences* for Dietary Fat Intake (-0.06).

It is unclear why *Preferences* for Dietary Fat and Added Sugar didn't perform well through various iterations of questionnaire reduction, especially since the foods included as examples were foods women consumed in the *¡Cocinar Para Su Salud!* study (as evidenced by their 24-hour recalls). As the majority of participants' annual household income is 15 thousand dollars or less, and there was no formal measure of literacy or numeracy in our baseline questionnaires, it is possible our participants did not understand the questions. Fruit and vegetable questions, and physical activity questions, were adapted from previously developed questionnaires. However, researchers primarily created questions regarding dietary fat and added sugar intake, which may mean that these questions need to undergo further validity testing. Future analyses should conduct extensive cognitive interviews with more participants, as the focus group used to modify the current questionnaire consisted only of four individuals.

Some researchers have developed and validated potential mediator questionnaires, especially for self-efficacy, to assess the impact on children's dietary behaviors (Hernandez-Garbanzo, Brosh, Serrano, Cason, & Bhattarai, 2013), and on physical activity, for a variety of populations including children and adults, and for adults with certain diseases, e.g. heart disease (Borges, Rech, Meurer, & Benedetti, 2015; Liang, Lau, Huang, Maddison, & Baranowski, 2014; Voskuil, Pierce, & Robbins, 2017). However, very little research has been conducted to understand psychosocial determinants of these lifestyle behaviors in general, and specifically for dietary fat and added sugar intake, for dietary and activity *Preferences* for these behaviors, among cancer survivors, and in Latina populations.

Strengths of the current analysis include the development based on previously validated surveys. The physical activity and fruit and vegetable scales were based on previously validated surveys with cancer survivors (James et al., 2011; Plotnikoff & Blanchard, 2001), and an adult

population mirroring the US population (Erinosho et al., 2015), respectively. The resulting questionnaire is brief, takes 10 to 15 minutes to complete, and is easy to administer. The questions are specifically targeted to our population so may be able to detect reasons for potential changes in behaviors after our intervention.

Consequently, this questionnaire can be used for measuring *Preferences* and *Self-efficacy* among Latina breast cancer survivors to examine the impact of interventions on these mediators for physical activity and diet behaviors and to conduct mediational analyses. Further work refining and testing this questionnaire should be completed in similar populations, including other Latina populations and among other cancer survivors.

Our sample was limited to Latina breast cancer survivors residing in an urban, low-income environment, who might not be representative of all Americans. Our results may not apply to all Latinas, or all cancer survivors. Self-efficacy and preferences of our key behaviors may differ based on income and socioeconomic status. The study sample size of n=30 is the minimum recommended for test-retest reliability; future studies could replicate our analyses with additional subjects (Polit, 2012). Our small focus group sample size, n=4, also limits the potential usefulness of Cognitive Interviews as a content validity assessment. Finally, self-report data suffer inherent limitations.

Reliability and validity are closely related and are fundamental prerequisites for each other (Tavakol & Dennick, 2011). The findings of this study, through qualitative and quantitative testing, provide evidence for the validity and reliability of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. A reliable questionnaire can help increase the probability of finding significant correlations and differences in a research project (DeVellis, 2011).

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# CHAPTER 4 ARTICLE 3: DIETARY AND PHYSICAL ACTIVITY PATTERNS AND RELATED PSYCHOSOCIAL FACTORS AMONG LATINA BREAST CANCER SURVIVORS: PRELIMINARY BASELINE RESULTS OF THE *MI VIDA SALUDABLE* STUDY

## 4.1 INTRODUCTION

One in eight women is diagnosed with breast cancer; and an expected 19 million women in the US will have been diagnosed with breast cancer in 2024. While Hispanic women have lower incidence rates of breast cancer than non-Hispanic whites, they at greater risk of breast cancer recurrence and are 20% more likely to die of breast cancer (Ooi, Martinez, & Li, 2011), possibly due to physical inactivity (Schoenborn & Heyman, 2009), high rates of diabetes and obesity (Hedley et al., 2004), and limited access to health care (Adams, Barnes, & Vickerie, 2008). Recommendations from the American Cancer Society (ACS) and the American Institute for Cancer Research (AICR) that ultimately aim to improve breast cancer recurrence rates include consuming at least 5 servings of fruits and vegetables per day, engaging in 150 minutes of moderate to vigorous physical activity per week, and consuming a diet low in energy dense (i.e. foods high in fat and added sugar) foods (Kushi et al., 2012; Rock et al., 2012). However, most breast cancer survivors are not meeting these guidelines; a study of National Health and Nutrition Examination Survey (NHANES) data found most breast cancer survivors are overweight (mean BMI 27.9 ± 1.0 $kg/m^2$), eat only 2.5 cup equivalents of fruits and vegetables each day, consume more than 30% of their dietary intake from solid fats, alcohol, and added sugars (Milliron, Vitolins, & Tooze, 2014); and are not meeting physical activity

recommendations (one-third to one-half are meeting recommendations) (Blanchard, Courneya, & Stein, 2008; LeMasters, Madhavan, Sambamoorthi, & Kurian, 2014). Lack of participation in these key behaviors is also related to increased risk of other chronic diseases such as cardiovascular disease, and unfortunately, female breast cancer survivors are more likely to die of these lifestyle-related chronic diseases than breast cancer itself (Chao et al., 2016; Ooi et al., 2011; Weaver et al., 2013).

Certain mediators as well as other psychological factors have been shown to predict diet and physical activity behaviors among children, adults, and various disease groups (Contento, 2015). However, these relationships have not been widely investigated among Latina breast cancer survivors. Understanding these relationships has the potential to impact the development of educational interventions, in order to improve these behaviors.

Of the few published interventions to improve lifestyle behaviors among Latina breast cancer survivors, Social Cognitive Theory (SCT) is the most widely used. In multiple adult populations, *preferences* and *self-efficacy*, two key potential mediators in SCT, have consistently correlated with physical activity and fruit and vegetable consumption. While the study of potential mediators has become relatively standard among researchers in the areas of nutrition and physical activity education, reports of whether interventions improve diet quality and physical activity based on changing these potential mediators is scarce (Diep, Chen, Davies, Baranowski, & Baranowski, 2014; Tate et al., 2016). More research is needed to improve development and application of lifestyle-behavior focused interventions, in all groups, but especially here for cancer survivors and racial/ ethnic minority groups (Greenlee et al., 2015).

In addition to psychosocial determinants, a number of other psychological factors are consistently related to diet and activity behaviors, including quality of life, locus of control, and

stress. The National Institutes of Health (NIH) have focused on clinical outcomes for many years, as they continue to do presently; but in 2004, the NIH began to emphasize patients' physical, mental, and social health, and developed the Patient-Reported Outcomes Measurement System (PROMIS) (Broderick, DeWitt, Rothrock, Crane, & Forrest, 2013). NIH hopes for researchers to implement PROMIS across studies in order to better compare psychosocial metrics across multiple populations. PROMIS measures have been validated in diverse cancer groups (Jensen et al., 2015), but some factors have shown mixed results related to diet and physical activity behaviors among cancer patients and survivors, including perceptions of general health or quality of life and depression (Boesen & Johansen, 2008; Haas, Martin, & Park, 2017; Hermanussen, Menendez, Chen, Ring, & Vranceanu, 2016; Kassianos, Raats, Gage, & Peacock, 2015; Menichetti et al., 2016; Rueda, Sola, Pascual, & Subirana Casacuberta, 2011). Regarding other related psychosocial determinants, mental stress has consistently been shown to impair appetite regulation and food "cravings", and decrease motivation for physical activity (Geiker et al., 2018). *Locus of control*, defined as individual's tendency to perceive the events that influence her as a result of either her own abilities and behaviors or as a result of external circumstances (Wallston, Stein, & Smith, 1994; Wallston, Wallston, & DeVellis, 1978), has also been shown to be related to diet and physical activity behaviors in middle-aged adults (Grisolia, Longo, Hutchinson, & Kee, 2015; Laffrey & Isenberg, 2003). However, results are limited with Hispanic/ Latina and breast cancer populations.

Further, systematic reviews have found that less acculturated Hispanics consume more fruit, rice, beans, and less sugar and sugar-sweetened beverages compared to their more acculturated counterparts (Ayala, Baquero, & Klinger, 2008). Obesity, a natural consequence of poor diet, may also be impacted by length of stay in the US, as those who have resided here for

longer periods have increased BMI levels (Isasi et al., 2015). Therefore, acculturation is examined here as a key factor regarding our lifestyle behaviors.

The current study is an analysis of baseline data from women participating in a larger trial, *Mi Vida Saludable* (My Healthy Life). *Mi Vida Saludable* is an ongoing randomized controlled trail (NIH R01 CA186080-01A1), which aims to determine separate and synergistic effects of theory-based nutrition and physical activity-education programs that are administered either a) in-person in a classroom setting or b) via electronic methods. *Mi Vida Saludable* targets Hispanic/Latina breast cancer survivors. The development of the *Mi Vida Saludable* intervention can be found in Chapter 2 of this dissertation.

In the *Mi Vida Saludable* trial, participants will be randomized into the study in 5 cohorts of 30-40 women over four years. This manuscript provides an analysis of the first three cohorts of participants randomized (n=95) into *Mi Vida Saludable*. The aims include: 1) examine diet and physical activity behaviors as they differ by acculturation level; and 2) examine whether diet and physical activity behaviors are predicted by psychosocial factors including self-efficacy, preferences, quality of life, stress, and locus of control.

## 4.2 METHODS

### 4.2.1 Recruitment

Study participants were recruited from Columbia University Medical Center (CUMC) oncology outpatient clinics via mailed and emailed letters to existing local breast cancer patient databases, Avon Army of Women, community advertising, recruitment at other New York metropolitan area cancer centers and clinics, and attendance at cancer awareness events

throughout New York City. Potential participants were eligible if they were female, ≥21 years of age, self-identified as Hispanic/ Latina, and were able to speak English or Spanish. In addition, women self-identified as having a medical history of histologically-confirmed stage 0-III breast cancer or with no evidence of metastatic disease and women self-reported they were ≥90 days post final treatment including chemotherapy, biologic therapy, i.e. trastuzumab, radiation therapy, or breast surgery (current use of hormonal therapy permitted). Participants were willing and able to receive emails and text messages and/ or attend educational classes for the *Mi Vida Saludable* trial, depending on how they would be randomized, and to travel to CUMC for data collection. Participants were excluded if they met any of the following four characteristics: were smokers, had uncontrolled diabetes mellitus defined as HgbA1C >7%, consumed ≥5 servings of fruits and vegetables per day and/ or engaged in ≥150 weekly minutes of moderate to vigorous physical activity. Of those screened (n=504), only n=15 (3.0%) participants were excluded based on eating 5 or more servings of fruits and vegetable per day and/ or engaging in 150 minutes or more of weekly moderate to vigorous physical activity. Participants received public transit travel reimbursement for data collection. The study was approved by the Columbia University Medical Center and Columbia University Teachers College Institutional Review Boards. All participants provided written informed consent.

### 4.2.2 Data Collection Overview

Baseline data were collected during two, in-person baseline sessions, one to three weeks apart. Multiple questionnaires were completed at both Baseline 1 and Baseline 2 clinic visits; the battery of questionnaires at the Baseline 1 clinic visit took approximately 60–90 minutes for

participants to complete. The Baseline 2 clinic visit was completed two-to-three weeks prior to the start of the classroom-based intervention.

### 4.2.3 Data Collection Measures

The following data types are assessed via self-report; participants are provided assistance by study staff as needed.

**Demographic and socioeconomic characteristics** assessed included age, race/ ethnicity and nationality, marital status, annual household income, SNAP and WIC participation, education level, and history of breast cancer treatment.

*Use of technology.* Use of technology included whether participants were comfortable using internet, email, and text messaging.

*Acculturation.* Acculturation was measured by the Short Acculturation Scale for Hispanics (SASH), which assesses language preferences based on personal use, media use, and social relationships, and has been validated in many Latino populations (Marin, Sabogal, Marin, Oterosabogal, & Perezstable, 1987). Higher scores indicate greater acculturation, or more habitual use of the English language. Scales are assessed via self-report. These data were collected at the Baseline 1 clinic visit.

**Physical activity** was measured by the Seven-Day Physical Activity Recall (7DPAR), which is a validated, brief assessment designed to gauge the amount of time spent engaged in various types of physical activity (Blair et al., 1985; Rauh, Hovell, Hofstetter, Sallis, & Gleghorn, 1992; Sallis et al., 1985). Study staff who were trained to follow a standardized protocol administered the 7DPAR, which has been previously validated in Latino adults (Rauh et al., 1992).

The 7DPAR yields a composite score that includes both the duration and intensity of physical activities participants engaged in during the past week. During data collection, physical activities are categorized as "moderate" (e.g., yoga, sweeping, walking 3-4 mph), "hard" (e.g., aerobic dance, fast walking, scrubbing floors), or "very hard" (e.g., circuit training, jumping rope, cross-country running). Participants were asked how many minutes they spent in the past 5 weekdays (weekdays determined by participants, e.g. if they worked on weekend days and had no work on certain days other than Saturday or Sunday) and weekend days doing activities in each of the 3 categories. Total weekly hours spent in each activity category, as well as category type, were calculated. 7DPAR was assessed during the Baseline 2 clinic visit.

**Dietary intake** was assessed using two to three 24-hour recall assessments using the multiple pass approach with the software program NDSR (versions 2016-2017, developed by the Nutrition Coordinating Center, University of Minnesota) (Dwyer, Picciano, & Raiten, 2003), which has been used frequently to measure dietary intake in a variety of Hispanic populations (Greenlee et al., 2015; Keller et al., 2014; Kieffer et al., 2014; Schneiderman, Chirinos, Aviles-Santa, & Heiss, 2014). Participants were excluded if they had fewer than two recalls.

Two of the recalls assessed diet for weekdays and one assessed diet for a weekend day. These assessments took place during a two-to-three week period; one recall was completed in person during the second baseline visit, and the other two recalls were completed over the phone in between the second baseline visit and the start of the classroom-based intervention. Participants were trained by research staff on how to estimate portion size during the recall sessions at the Baseline 2 clinic visit with food models and the NDSR *Food Amounts Booklet*. The *Food Amounts Booklet* is provided to participants to take home to use during their phone-based sessions. If participants lose their booklets, they are mailed new ones by study staff.

A certified NDSR data collector (certified by the Nutrition Coordinating Center, University of Minnesota) trained research staff over a two-to-three week period before data collection occurred. The training, based on the certification training manual and procedures, included a detailed review of the NDSR database, oversight of recall procedures, and 10–15 practice recalls until the certified data collector deemed the data collectors' recalls as sound.

The certified NDSR data collector also assessed all 24-hour recalls for quality assurance, examining portion size and food types selected for accuracy in reporting. NDSR output provides data on numerous foods and nutrients, of which those of interest to this study were average number of servings of fruits and vegetables per day by fruit and vegetable subgroup, percent daily calories of fat per day, and grams of added sugar per day. Fruit and vegetable servings were calculated separately for *total* fruit and vegetable servings, as well as those *targeted* in the *Mi Vida Saludable* curriculum, which exclude beans, potatoes, and juices. Percent of added sugar per day can be calculated from grams.

**Height and weight.** Trained study staff measured height and weight using a standardized protocol. Height was measured using a calibrated stadiometer and weight was measured using a calibrated SR Instruments SR scale.

**Potential mediators** were assessed via *Social Cognitive Theory Potential Mediator Questionnaire for Latinas*; a validated questionnaire assessing self-efficacy and preferences for the target behaviors of *Mi Vida Saludable,* rooted in Social Cognitive Theory, described in detail in Chapter 3 of this dissertation. Briefly, self-efficacy and preferences are assessed on Likert-scale for physical activity, fruit and vegetable intake, and intake of dietary fat and added sugar. Preferences for various activities and diet choices are assessed from 1-5 (*strongly dislike* to *strongly like*); an option was available for "never tried it", coded as "0". Self-efficacy choices

also ranged from 1-5 (*not at all confident* to *extremely confident*). Scales were assessed via self-report and participants were assisted by study staff if appropriate. The survey took between 15-30 minutes to complete, and was assessed at the Baseline 1 clinic visit.

**Quality of life** was measured using three tools: PROMIS 10 Global Health questionnaire (PROMIS 10), Mental Health Locus of Control questionnaire (MHLC), and the Social Readjustment Rating Questionnaire (SRRS). All measures were assessed during the Baseline 1 clinic visit. Each measure took less than 10 minutes to complete.

*PROMIS 10 Global Health Questionnaire (PROMIS-10; "PROMIS-10 Global Health").* The PROMIS-10 was developed by the National Institutes of Health (NIH) to assess generic health-related quality of life compared with population norms (Broderick et al., 2013; Jensen et al., 2015). The PROMIS-10 is a 10-question survey that assesses generic health-related quality of life compared with population norms. PROMIS-10 gives a summary indicator of health status by assessing five domains: physical function, fatigue, pain, emotional distress, and social health. Nine of 10 questions are answered using 5-point Likert scales, and the 10th question is answered using a numerical rating scale. The PROMIS-10 yields a physical health score and a mental health quality of life score that are both transformed to t-score distributions with a mean of 50 and standard deviation of 10 (Broderick et al., 2013; Jensen et al., 2015). Scores are summed by Physical health-related quality of life and Mental health-related quality of life question types, and then converted to T-scores and Standard Error. PROMIS-10 scores have shown to be reliable and valid in a large patient samples in the US general population. Higher scores indicate greater quality of life.

*Social Readjustment Rating Scale (SRRS; "Social Readjustment").* The Social Readjustment Rating Scale (SRRS) measures life events that occurred over the 12 months prior

to when the survey was conducted (Bieliauskas & Webb, 1974; Holmes & Rahe, 1967). Participants are asked about 41 life events that are thought to evoke some significant change in an individual's life. The SRRS assigns each life event to predetermined life change units values ranging from 11 to 100, thought to correspond to "the amount and duration of change in one's accustomed pattern of life" (Bieliauskas & Webb, 1974; Holmes & Rahe, 1967). Values are then summed to calculate a total score for each participant. Summed scores were categorized as low (<150), medium (150–299), or high stress (≥300) for each person (Bieliauskas & Webb, 1974; Holmes & Rahe, 1967).

*Multidimensional Health Locus of Control (MHLC; "Health Locus of Control")*. Locus of control is defined as individual's tendency to perceive the events that influence her as a result of either her own abilities and behaviors or as a result of external circumstances (Wallston et al., 1994; Wallston et al., 1978). The MHLC scale includes 18 items comprising three subscales of six items each: *Internal* (internal factors related to health control), *Powerful Others* (tendencies that are related to powerful others, such as health professionals and family members), and *Chance* (tendencies and external factors related to chance or fate) (Wallston et al., 1994; Wallston et al., 1978). The responses to the items are scored on a six-point Likert scale from "strongly agree" to "strongly disagree."

### 4.2.4 Analyses

The primary goal of this study was to determine whether the following psychosocial variables predict physical activity, fruit and vegetable intake, and dietary fat, and added sugar intake. The potential mediators *Preferences* and *Self-efficacy* are behavior-specific, and assess each target behavior separately; and the quality of life variables PROMIS-10 Global Health,

Social Readjustment, and Health Locus of Control, were assessed with general questions involving only one scale each, i.e. not behavior-specific.

Statistical analyses were performed using IBM SPSS Statistics, version 20 (SPSS Inc, Chicago, IL, 2012). Descriptive statistics calculated were means, standard deviations, and ranges examined demographic and socioeconomic characteristics, medical history, and use of technology, key food and physical activity behavior behaviors, potential mediators, and quality of life and locus of control variables. Participants were also separated by median acculturation level, and compared with an independent t-test.

Potential confounding factors of age, income, education, and acculturation were identified based on theoretical considerations and previous literature among adults. These variables were included in all of the models *a priori*. Age, income, education, and acculturation have shown to be related to fruit and vegetable intake (Hong, Kim, & Kim, 2012; Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017) and physical activity (Koyanagi, Stubbs, & Vancampfort, 2017; Lopez & Yamashita, 2017; Shuval, Li, Gabriel, & Tchernis, 2017) and, in some instances, dietary fat and added sugar intake (Ayala et al., 2008).

Descriptive statistics of outcome variables indicated some needed adjustments as follows. Physical activity, fruit and vegetable intake (both total and targeted), and added sugar intake were skewed to the right. Therefore, physical activity, fruit and vegetable intake (both total and targeted), and added sugar intake were transformed by a Log10 conversion to create normal distributions. Dietary fat intake was normally distributed and did not require a transformation.

Multiple regression models were created to determine whether each of the four outcome behaviors (fruit and vegetable intake, dietary fat intake, added sugar intake, and physical activity) were predicted by each potential mediator, *Preferences* and *Self-efficacy*, separately.

Regression models were also created to determine whether each of the outcome variables, fruit and vegetable intake, dietary fat intake, added sugar intake, and physical activity, were predicted by the three Quality of Life measures, PROMIS-10 Global Health, Social Readjustment, and Health Locus of Control. Separate models were created for each independent variable.

Each model controlled for all of the confounding variables listed above, age, income, education, and acculturation. As these potential confounding variables have shown to be related to our outcome variables, they were included in our models throughout. For models predicting behaviors based on potential mediators, models were built for each independent variable separately, and then with both potential mediators together. Potential mediators were combined because they are based in Social Cognitive Theory, and aim to predict behavior together (see Chapter 3 of this dissertation). Three models were built for each dependent variable; 15 models were built for the potential mediator independent variables. For models predicting behaviors based on Quality of Life measures, each Quality of Life independent measure was included in separate models, as no literature exists to suggest that these three measures should be examined together to predict lifestyle behaviors. Three models were built for each dependent variable; 15 models were built for the Quality of Life independent variables.

## 4.3 RESULTS

### 4.3.1 Participant Characteristics

Among the women recruited for *Mi Vida Saludable,* n=95 were randomized to a condition for the first three cohorts (Table 4.1). Average age was 55.3 (SD=9.4) years; about one-third (32.6%) of women identified as Black Caribbean Hispanic, and about one in seven

women identified as Central or South American Hispanic (13.7%) or White Caribbean Hispanic (16.8%). With respect to national background, the vast majority of women identified Dominican (76.8%). Mean acculturation score was 1.92 (SD=0.60) on a 1-5 scale), and median score was 1.90 (data not shown). Highest level of education was evenly distributed; with about one-quarter (27.4%) less than a high school education (27.4%), 17.9% high school, 29.5% some college, 23.2%), college or higher degree. Annual household income was less evenly distributed. The majority (56.8%) earned less than $15,000, and about half of women (55.8%) participated in the Supplemental Nutrition Assistance Program. In addition, about half of women had received chemotherapy (53.7%), hormonal therapy (52.6%), or radiation therapy (57.9%), while 98.9% received surgery as previous treatment for breast cancer. Participants were moderately comfortable (mean range 2.20 – 2.84) using the internet, email, and text messaging. Mean BMI was overweight (29.8 kg/m$^2$).

**Table 4.1. Demographic and socioeconomic variables, medical history, and use of technology in first three cohorts of Latina breast cancer survivors participating in Mi Vida Saludable trial (n=95)**

| **Variable** | | |
|---|---|---|
| **Age** | | |
| Years, mean (SD) | 55.3 | 9.4 |
| missing | 0 | - |
| n (%) | | |
| <50 years | 27 | 28.4% |
| 50-59 years | 35 | 36.8% |
| 60+ years | 33 | 34.7% |
| **Race/ethnicity, n (%)** | | |
| Hispanic Black/ African American/ African descent | 1 | 1.1% |
| Central or South American Hispanic | 13 | 13.7% |
| White Caribbean Hispanic | 16 | 16.8% |
| Black Caribbean Hispanic | 31 | 32.6% |
| Caribbean Indian or North American Hispanic | 4 | 4.2% |
| Missing | 4 | 4.2% |
| **National Background, n (%)** | | |
| Argentinean | 1 | 1.1% |
| Columbian | 3 | 3.2% |

| | | |
|---|---|---|
| Dominican | 73 | 76.8% |
| Ecuadorian | 6 | 6.3% |
| Salvadorian | 1 | 1.1% |
| Honduran | 1 | 1.1% |
| Mexican | 2 | 2.1% |
| Puerto Rican | 6 | 6.3% |
| Missing | 0 | 0.0% |
| **Education, n (%)** | | |
| Less than high school | 26 | 27.4% |
| High school graduate or GED | 17 | 17.9% |
| Some college but not a graduate | 28 | 29.5% |
| College degree; Master's or doctoral degrees | 22 | 23.2% |
| Missing | 2 | 2.1% |
| **Annual household income, n (%)** | | |
| $0 - $15,000 | 54 | 56.8% |
| $15,001 - $30,000 | 19 | 20.0% |
| $30,001 - $60,000 | 10 | 10.5% |
| $60,001 - $100,000 | 8 | 8.4% |
| Missing | 4 | 4.2% |
| **SNAP or WIC Participation, n (%)** | | |
| SNAP | 53 | 55.8% |
| WIC | 3 | 3.2% |
| Missing | 0 | 0.0% |
| **Received chemotherapy, n (%)** | | |
| Yes | 51 | 53.7% |
| No | 42 | 44.2% |
| Missing | 2 | 2.1% |
| **Received hormonal therapy, n (%)** | | |
| Yes | 50 | 52.6% |
| No | 44 | 46.3% |
| Missing | 1 | 1.1% |
| **Received radiation treatment, n (%)** | | |
| Yes | 55 | 57.9% |
| No | 38 | 40.0% |
| Missing | 2 | 2.1% |
| **Received surgery, n (%)** | | |
| Yes | 94 | 98.9% |
| No | 1 | 1.1% |
| Missing | 0 | 0% |
| **Use of Technology[1], mean (SD)** | | |
| Comfortable using internet | 2.65 | 1.44 |
| Missing | 0 | - |
| Comfortable using email | 2.84 | 1.59 |
| Missing | 1 | 1.1% |
| Comfortable using text messaging | 2.20 | 1.20 |
| Missing | 1 | 1.1% |

| | | |
|---|---|---|
| **Acculturation[2], mean (SD)** | 1.92 | 0.60 |
| Range | 1 – 3.2 | |
| Missing | 0 | - |
| **BMI, mean (SD)[3]** | 29.8 | 4.9 |
| Missing | 3 | 3.2% |

Note

Abbreviations: SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Program for Women, Infants, and Children; BMI, Body Mass Index

1. Response options: 1= extremely comfortable; 2= very comfortable; 3= somewhat comfortable; 4= not very comfortable; 5= not at all comfortable; 6= does not use
2. Range of acculturation scores (1=Spanish only, i.e. less acculturated; 5=English only, more acculturated)
3. BMI is calculated as kg/ $m^2$

### 4.3.2 Unadjusted Analyses

Mean fruit and vegetable intake was 5.37 servings (SD=3.3) for total intake, and 4.01 (SD=3.1) for targeted intake (Table 4.2). Average percent fat consumption was 28.6%. There were no statistically significant differences between low and high acculturation groups. Average dietary sugar intake was 8.30%; low acculturated groups consumed statistically significantly ($p<0.05$) greater sugar (8.91%) compared to the high-acculturated group (6.31%).

**Table 4.2. Dietary intake based on average 24-hour recalls among first three cohorts of participants in the Mi Vida Saludable trial (n=95)**

| | Total Mean (SD) | Low acculturation[1] Mean (SD) | High acculturation[2] Mean (SD) |
|---|---|---|---|
| **Fruit and vegetable intake, *servings per day*** | | | |
| Total | 5.37 (3.3) | 4.76 (2.0) | 5.50 (3.6) |
| Targeted[3] | 4.01 (3.1) | 3.43 (2.1) | 4.18 (3.3) |
| Missing | 0 (-) | 0 (-) | 0 (-) |
| **Dietary Fat intake, *% energy intake*** | 28.60 (6.6) | 27.05 (6.0) | 28.99 (6.8) |
| Missing | 0 (-) | 0 (-) | 0 (-) |
| **Added sugar intake, *% energy intake*** | 8.30 (5.3) | 8.91 (5.5)* | 6.31 (3.8) |
| Missing | 0 (-) | 0 (-) | 0 (-) |

Note

1. Low acculturation corresponds to less than or equal to median acculturation level, 1.9
2. High acculturation corresponds to greater than the median acculturation level, 1.9
3. Targeted excludes beans, potatoes, and juices

*$p<0.05$

With respect to physical activity (Table 4.3), women engaged in 44.4 minutes (SD= 47.3) of moderate to vigorous physical activity on average, daily. Moderate activity comprised most of the exercise ($\bar{x}$ =31.1 minutes; SD= 37.1). For moderate to vigorous activity types, low acculturated groups engaged in fewer minutes of activity, but not significantly fewer than the high-acculturated group.

Average minutes per day of type of activity varied (Table 4.3). The most common method of activity was walking as a non-work related activity. The low acculturated group performed statistically significantly fewer minutes of non-work related "other" types of physical activity ($\bar{x}$= 2.2, SD= 5.3 vs. $\bar{x}$= 6.2, SD= 14.5), but statistically significantly more minutes of "other" non-work related physical activity ($\bar{x}$= 6.2, SD= 28.4 vs. $\bar{x}$= 0.0, SD= 0.0). No additional data are available to identify what "other" refers to. There were no other statistically significant differences between acculturated groups for the remaining types of activity.

**Table 4.3. Physical activity based on 7-day physical activity recall among first three cohorts of participants in the Mi Vida Saludable trial (n=95)**

| | Total Mean (SD) | Low acculturation[1] Mean (SD) | High acculturation[2] Mean (SD) |
|---|---|---|---|
| **Intensity, *minutes per day*** | | | |
| Moderate | 31.1 (37.1) | 29.5 (39.5) | 32.9 (6.5) |
| Hard | 5.6 (20.8) | 4.8 (18.8) | 6.5 (23.0) |
| Very hard | 2.5 (7.6) | 2.5 (7.4) | 2.6 (7.9) |
| Moderate – Very hard | 44.4 (47.3) | 41.7 (49.3) | 47.7 (45.1) |
| Missing | 0 (-) | 0 (-) | 0 |
| **Type, *minutes per day*** | | | |
| Walk, non-work related | 21.6 (17.0) | 25.5 (21.7) | 20.5 (15.4) |
| Walk, work related | 2.9 (17.1) | 2.9 (13.1) | 2.9 (18.2) |
| Zumba or dance, non-work related | 0.48 (2.1) | 0.43 (2.0) | 0.5 (2.1) |
| Zumba or dance, work-related | 0 (-) | - | - |
| Dance, non-work related | 0.24 (1.5) | 0.19 (0.9) | 0.3 (1.7) |
| Dance, work related | 0 (-) | - | - |
| Household chores, non-work related | 5.2 (24.1) | 1.3 (4.6) | 6.2 (27.1) |
| Household chores, work related | 1.8 (15.2) | 0 (-) | 2.4 (17.2) |
| Cycle, non-work related | 0.1 (0.7) | 0.14 (0.7) | 0.11 (0.7) |
| Cycle, work-related | 0 (-) | - | - |
| Other, non-work related | 5.3 (13.3) | 2.2 (5.3) | 6.2 (14.5)* |
| Other, work-related | 1.4 (13.3) | 6.2 (28.4)* | 0 (-) |

Note
1. Low acculturation (scale 1-5) corresponds to less than or equal to median acculturation level, 1.9
2. High acculturation (scale 1-5) corresponds to greater than the median acculturation level, 1.9
*$p<0.05$

*The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* (Table 4.4) mean responses to preferences (0–5 range) and self-efficacy (1–5 range) for physical activity fell at an average level ($\bar{x}$= 2.8, SD= 0.9; $\bar{x}$= 2.9, SD= 0.8). Mean scores for preferences and self-efficacy of dietary behaviors were higher, ranging from $\bar{x}$= 3.0 to $\bar{x}$= 3.9. With respect to quality of life and locus of control measures (Table 4.5), PROMIS physical health quality of life mean scores were 47.7 (SD=4.2) and mental health quality of life mean scores were 44.0 (SD=3.6). Locus of control mean scores were similar for Internal and Chance sub-scales, but lower for Powerful Others sub-scale ($\bar{x}$= 18.0, SD= 6.8). Social readjustment mean scores were 130.3 (SD=94.0).

**Table 4.4. Preferences and self-efficacy determinants from *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* for first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial (n=85)**

| | Items | No. of items | Mean | SD |
|---|---|---|---|---|
| **Physical Activity** | **Preferences**[1]<br>Please indicate which types of physical activity you like to do.<br>*E.g. Walking at a brisk pace for leisure*<br>*E.g. Doing housework with vigorous effort* | 8 | 2.8 | 0.9 |
| | **Self-efficacy**[2]<br>How confident are you that you could participate in regular moderate to vigorous physical activity over the next month?<br>*E.g. When you are a little tired*<br>*E.g. When you are in a bad mood or feeling depressed* | 5 | 2.9 | 0.8 |
| **Fruit and Vegetable Intake** | **Preferences**[1]<br>For each of the fruits and vegetables listed below, how much do you like or dislike each type of fruit or vegetable?<br>*E.g. Leeks*<br>*E.g. Broccoli* | 6 | 3.0 | 1.1 |
| | **Self-efficacy**[2]<br>Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?<br>*E.g. Eat a healthy snack, like a fruit or a vegetable, when you're really hungry?*<br>*E.g. Eat fruits and vegetables when your family and friends are eating junk foods like chips, cookies, or candy?* | 4 | 3.9 | 0.6 |
| **Dietary Fat** | **Preferences**[1] | 6 | 3.5 | 0.7 |

| | | | | |
|---|---|---|---|---|
| **Intake** | How much do you like or dislike each type of food or drink listed below?<br>*E.g. Chicken or turkey slices*<br>*E.g. Baked (not regular, fried) plantain or potato chips* | | | |
| | **Self-efficacy**[2]<br>Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?<br>*E.g. Choose chicken or turkey slices instead of salami, sausage, or ham?*<br>*E.g. Choose baked (not regular, fried) plantain or potato chips instead of regular plantain or potato chips* | 6 | 3.9 | 0.6 |
| **Added Sugar Intake** | **Preferences**[1]<br>How much do you like or dislike each type of food or drink listed below?<br>*E.g. Coffee or tea without added sugar*<br>*E.g. Cold cereal without any type of added sugar like regular Cheerios* | 6 | 3.7 | 0.6 |
| | **Self-efficacy**[2]<br>Assuming that you want to, how confident are you that you could do each of the following starting this week and continuing for at least 1 month?<br>*E.g. Choose coffee or tea without added sugar instead of coffee or tea with added sugar?*<br>*E.g. Cold cereal without any type of added sugar like regular Cheerios instead of cold cereal with added sugar like Maple and Brown Sugar Oatmeal, or Cream of Wheat with added sugar?* | 6 | 3.8 | 0.7 |

**Note**
1. Range of scores 0-5 (0=never tried it, 5=strongly like), higher scores indicate greater preference
2. Range of scores 1-5 (0=not at all confident, 5=extremely confident), higher scores indicate greater self-efficacy

**Table 4.5. Outcomes of quality of life and locus of control measures in first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial (n=85)**

| | No. of items | Mean (SD) |
|---|---|---|
| **PROMIS Global Health** | | |
| Physical Health[1] | 4 | 47.7 (4.2) |
| Mental Health[2] | 4 | 44.0 (3.6) |
| **Locus of Control**[3] | | |
| Subscale: Internal | 6 | 26.1 (5.3) |
| Subscale: Chance | 6 | 25.2 (5.5) |
| Subscale: Powerful Others | 6 | 18.0 (6.8) |
| **Social Readjustment**[4] | 43 | 130.3 (94.0) |

Note
1. Higher scores (converted T score range 16.2-67.7) denote higher physical quality of life
2. Higher scores (converted T score range 21.2-67.6) denote higher mental quality of life
3. Response options range (1=strongly disagree to 6=strongly agree); higher scores denote greater agreement; range of scores 6 - 36
4. Higher scores denote increased stress; range of possible scores 0 - 1467

### 4.3.3 Adjusted Analyses

Regarding regression models predicting outcome behaviors by corresponding preferences and self-efficacy measures (Table 4.6), a 1-unit increase in the self-efficacy for decreasing added

sugar scale was related to a decrease of 15.6% (p=0.002) of added sugar intake controlling for age, education, income, and acculturation. This relationship was also seen when self-efficacy was included in the model with preferences; a 1-unit increase in the self-efficacy for decreasing added sugar scale was related to a decrease of 18.1% (p=0.001) added sugar intake. In addition, a 1-unit increase in the preferences scale for dietary fat was related to a decrease of 1.7% (p=0.04) in dietary fat intake, controlling for age, education, income, and acculturation. All other models were not statistically significant.

**Table 4.6. Multiple Linear Regression Results for Associations of Preferences and Self-efficacy with Fruit and Vegetable Consumption, Fat Intake, and Added Sugar Intake, and Physical Activity in first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial (n=85)**

| | Dependent Variable with Corresponding Determinants | *B* | $SE_B$ | 95% CI | P-value |
|---|---|---|---|---|---|
| **Diet** | **Fruit and Vegetable Intake**[3] | | | | |
| | Total Fruit and Vegetable Intake: Model 1: Preferences[1] | 0.03 | 0.03 | -0.03 – 0.08 | 0.32 |
| | Total Fruit and Vegetable Intake: Model 2: Self-efficacy[2] | 0.05 | 0.05 | -0.04 – 0.14 | 0.27 |
| | Total Fruit and Vegetable Intake: Model 3: Preferences[1] and Self-efficacy[2] | | | | |
| | Preferences | 0.02 | 0.03 | -0.03 – 0.07 | 0.44 |
| | Self-efficacy | 0.04 | 0.05 | -0.05 – 0.14 | 0.36 |
| | Targeted Fruit and Vegetable Intake[4]: Model 1: Preferences[1] | 0.05 | 0.03 | -0.02 – 0.11 | 0.14 |
| | Targeted Fruit and Vegetable Intake[4]: Model 2: Self-efficacy[2] | 0.08 | 0.06 | -0.03 – 0.20 | 0.16 |
| | Targeted Fruit and Vegetable Intake[4]: Model 3: Preferences[1] and Self-efficacy[2] | | | | |
| | Preferences | 0.04 | 0.03 | -0.03 – 0.11 | 0.23 |
| | Self-efficacy | 0.07 | 0.06 | -0.05 – 0.20 | 0.23 |
| | **Dietary Fat Intake**[5] | | | | |
| | Model 1: Preferences[1] | 0.32 | 1.08 | -1.83 – 2.47 | 0.77 |
| | Model 2: Self-efficacy[2] | -0.17 | 1.22 | -2.10 – 3.99 | 0.54 |
| | Model 3: Preferences[1] and Self-efficacy[2] | | | | |
| | Preferences | -1.70 | 0.80 | -3.29 - -0.10 | 0.04 |
| | Self-efficacy | 0.85 | 1.28 | -1.71 – 3.40 | 0.51 |
| | **Added Sugar Intake**[5] | | | | |
| | Model 1: Preferences[1] | -0.03 | 0.06 | -0.15 – 0.08 | 0.55 |
| | Model 2: Self-efficacy[2] | -0.17 | 0.05 | -0.27 – -0.06 | 0.002 |
| | Model 3: Preferences[1] and Self-efficacy[2] | | | | |
| | Preferences | 0.06 | 0.06 | -0.06 – 0.19 | 0.29 |
| | Self-efficacy | -0.20 | 0.06 | -0.32 - -0.08 | 0.001 |
| **Physical Activity**[6] | Model 1: Preferences[1] | 0.01 | 0.05 | -0.10 – 0.11 | 0.91 |
| | Model 2: Self-efficacy[2] | -0.02 | 0.06 | -0.13 – 0.09 | 0.68 |
| | Model 3: Preferences[1] and Self-efficacy[2] | | | | |
| | Preferences | 0.01 | 0.05 | -0.10 – 0.11 | 0.88 |

| | | | | |
|---|---|---|---|---|
| Self-efficacy | -0.02 | 0.06 | -0.14 – 0.09 | 0.67 |

Note
Abbreviations: CI, confidence interval
Each analysis controlled for age, education, income, and acculturation
1. Higher scores (range 0-5) indicate increased preference
2. Higher scores (range 1-5) indicate increased confidence
3. Fruit and vegetable intake is measured in servings per day
4. Targeted excludes beans, potatoes, and juices
5. Dietary fat intake and added sugar intake are measured as percent of calories per day
6. Physical activity is measured in minutes of moderate to vigorous physical activity each week

For regression models predicting outcome behavior by quality of life (Table 4.7), a 1-unit increase in the Mental health-related quality of life PROMIS measure was related to an increase of 1.01 (p=0.03) and 1.02 (p=0.02) servings in total and targeted fruit and vegetable intake servings, respectively, controlling for age, education, income, and acculturation. A 1-unit increase in the Mental health-related quality of life PROMIS measure was also statistically significantly related to an increase of 1.02 (p=0.01) minutes of moderate-to-vigorous physical activity. In addition, a 1-unit increase in the Mental health-related quality of life PROMIS measure was related to a decrease of 0.31% (p=0.049) of dietary fat intake, controlling for age, education, income, and acculturation. Finally, a 1-unit increase in the Locus of Control – Powerful Others sub-scale was related to a 2.0% decrease (p=0.01) in added sugar intake, controlling for age, education, income, and acculturation; and a 1 unit increase in the Social Readjustment scale was related to a 1.0% increase (p=0.049) in added sugar intake, controlling for age, education, income, and acculturation. Table 4.8 is a summary table of all results from the regression analyses.

**Table 4.7. Multiple Linear Regression Results for Associations of Preferences and Self-efficacy and Fruit and Vegetable Consumption, Fat Intake, and Added Sugar Intake, and Physical Activity in first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial (n=85)**

| | Dependent Variable | Determinant | *B* | $SE_B$ | 95% CI | P-value |
|---|---|---|---|---|---|---|
| **Diet** | **Fruit and Vegetable Intake**[1] | | | | | |
| | **Total Fruit and Vegetable Intake: Model 1: PROMIS-Global** | Physical[4] | -0.002 | 0.01 | -0.01 – 0.01 | 0.70 |
| | | Mental[5] | 0.01 | 0.01 | 0.001 – 0.02 | 0.03 |
| | **Total Fruit and Vegetable Intake: Model 2: Locus of Control** | Internal[6] | -0.001 | 0.01 | -0.01 – 0.01 | 0.80 |
| | | Chance[6] | -0.004 | 0.004 | -0.01 – 0.01 | 0.40 |
| | | Powerful Others[6] | 0.01 | 0.01 | -0.01 – 0.02 | 0.26 |
| | **Total Fruit and Vegetable Intake: Model 3: Social readjustment**[7] | | <0.001 | 0.001 | -0.002 – 0.002 | 0.94 |
| | **Targeted Fruit and Vegetable Intake: Model 1: PROMIS-Global** | Physical[4] | -0.004 | 0.01 | -0.02 – 0.01 | 0.52 |
| | | Mental[5] | 0.02 | 0.01 | 0.003 – 0.03 | 0.02 |
| | **Targeted Fruit and Vegetable Intake: Model 2: Locus of Control** | Internal[6] | 0.001 | 0.01 | -0.01 – 0.02 | 0.92 |
| | | Chance[6] | -0.004 | 0.01 | -0.02 – 0.01 | 0.44 |
| | | Powerful Others[6] | 0.002 | 0.01 | -0.01 – 0.02 | 0.76 |
| | **Targeted Fruit and Vegetable Intake: Model 3: Social readjustment**[7] | | <0.001 | 0.001 | -0.003 – 0.002 | 0.85 |
| | **Dietary Fat**[3] | | | | | |
| | **Model 1: PROMIS-Global** | Physical[4] | 0.15 | 0.14 | -0.13 – 0.43 | 0.29 |
| | | Mental[5] | -0.31 | 0.16 | -0.62 – -0.01 | 0.049 |
| | **Model 2: Locus of Control** | Internal[6] | 0.16 | 0.15 | -0.15 – 0.46 | 0.31 |
| | | Chance[6] | -0.12 | 0.12 | -0.36 – 0.13 | 0.34 |
| | | Powerful Others[6] | 0.09 | 0.16 | -0.24 – 0.41 | 0.59 |
| | **Model 3: Social readjustment**[7] | | -0.04 | 0.03 | -0.09 – 0.01 | 0.13 |
| | **Added Sugar Intake**[3] | | | | | |
| | **Model 1: PROMIS-Global** | Physical[4] | 0.01 | 0.01 | -0.01 – 0.02 | 0.30 |
| | | Mental[5] | -0.001 | 0.01 | -0.02 – 0.02 | 0.94 |
| | **Model 2: Locus of Control** | Internal[6] | 0.01 | 0.01 | -0.01 – 0.02 | 0.44 |
| | | Chance[6] | 0.01 | 0.01 | -0.004 – 0.02 | 0.23 |
| | | Powerful Others[6] | -0.02 | 0.01 | -0.04 – 0.01 | 0.01 |
| | **Model 3: Social readjustment**[7] | | 0.003 | 0.001 | <0.001 – 0.01 | 0.049 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Physical Activity[8]** | **Model 1: PROMIS-Global** | Physical[4] | -0.004 | 0.01 | -0.02 – 0.01 | 0.62 |
| | | Mental[5] | 0.02 | 0.01 | 0.01 – 0.04 | 0.01 |
| | **Model 2: Locus of Control** | Internal[6] | -0.005 | 0.01 | -0.02 – 0.01 | 0.62 |
| | | Chance[6] | -0.002 | 0.01 | -0.02 – 0.01 | 0.79 |
| | | Powerful Others[6] | 0.01 | 0.01 | -0.01 – 0.03 | 0.31 |
| | **Model 3: Social readjustment[7]** | | -0.001 | 0.002 | -0.004 – 0.002 | 0.56 |

Note
Abbreviations: CI, confidence interval
The fully adjusted analysis controlled for age, education, income, and acculturation
1. Fruit and vegetable intake is measured in servings per day
2. Targeted excludes beans, potatoes, and juices
3. Dietary fat intake and added sugar intake are measured as percent of calories per day
4. Higher scores (converted T score range 16.2-67.7) denote higher physical quality of life
5. Higher scores (converted T score range 21.2-67.6) denote higher mental quality of life
6. Higher scores (range 6-36) indicate increased locus of control provided by self, powerful others, or by chance
7. Higher scores (range 0-300) indicate increased stress
8. Physical activity is measured in minutes of moderate to vigorous physical activity each week

## Table 4.8. Multiple Linear Regression Results for Associations of Each Independent Variable with Fruit and Vegetable Consumption, Fat Intake, and Added Sugar Intake, and Physical Activity in first three cohorts of Latina breast cancer survivors participating in *Mi Vida Saludable* trial (n=85)

| Independent Variable | Fruit and Vegetable Intake: Total[3] | Fruit and Vegetable Intake: Targeted[4] | Fat Intake[5] | Added Sugar Intake[5] | Physical Activity[6] |
|---|---|---|---|---|---|
| Preferences[1] | | | -1.7% | | |
| Self-efficacy[2] | | | | -15.6% | |
| PROMIS - Global | | | | | |
| Mental health[8] | 1.01 | 1.02 | -0.31% | | 1.02 |
| Physical health[7] | | | | | |
| Locus of Control[9] | | | | -2.0% | |
| Social Readjustment[10] | | | | 1.0% | |

Note
Abbreviations: CI, confidence interval
Each analysis controlled for age, education, income, and acculturation
1. Higher scores (range 0-5) indicate increased preference
2. Higher scores (range 1-5) indicate increased confidence
3. Fruit and vegetable intake is measured in servings per day
4. Targeted excludes beans, potatoes, and juices
5. Dietary fat intake and added sugar intake are measured as percent of calories per day
6. Physical activity is measured in minutes of moderate to vigorous physical activity each week
7. Higher scores (converted T score range 16.2-67.7) denote higher physical quality of life
8. Higher scores (converted T score range 21.2-67.6) denote higher mental quality of life
9. Higher scores (range 6-36) indicate increased locus of control provided by self, powerful others, or by chance
10. Higher scores (range 0-300) indicate increased stress

## 4.4 DISCUSSION

Our study found that, among Hispanic/ Latina breast cancer survivors, decreased self-efficacy to choose lower sugar foods, increased locus of control of powerful others, and increased stress are related to increased added sugar intake. We also found that increased preferences for foods low in fat are related to decreased fat intake. Finally, we found higher mental health-related quality of life scores are related to increased fruit and vegetable intake, decreased fat intake, and increased physical activity.

This study examined the associations between psychosocial variables and key lifestyle behaviors proven to affect breast cancer recurrence, among Hispanic/ Latina breast cancer survivors. The psychosocial variables included two potential mediators from Social Cognitive Theory: preferences and self-efficacy; three quality of life measures: PROMIS physical and mental health-related quality of life sub-scales, stress measured by the Social Readjustment Rating Scale, and Locus of Control. The lifestyle behaviors of interest were increasing daily minutes of moderate-to-vigorous physical activity, increasing fruit and vegetable intake, and decreasing added sugar and fat intake as percentages of daily calories.

AICR & ACS recommend consuming at least 5 servings of fruits and vegetables per day, engaging in 150 minutes of moderate to vigorous physical activity per week, and consuming a diet low in energy dense (i.e. foods high in fat and added sugar) foods (Kushi et al., 2012; Rock et al., 2012). The Dietary Guidelines for Americans (DGA) recommend a diet with less than 10% of calories from added sugar between 20 to 35% from dietary fat. Our results showed that typical behaviors for Hispanic/ Latina breast cancer survivors included consuming the recommended amount of servings of fruits and vegetables, consuming dietary fat and added sugar within the

DGA recommended levels, and participating in the recommended minutes of weekly moderate to vigorous physical activity.

As the general cancer survivor population does not consume the recommended number of servings of fruits and vegetables and a diet low in fat and added sugar, and does not participate in the recommended amount of physical activity, these results are surprising (Blanchard et al., 2008; LeMasters et al., 2014; Milliron et al., 2014). One potential reason for our results may be the progressive legislature and nature of New York City, where healthy eating programs are numerous and available for many low income and underserved populations. In addition, those living in cities are more likely to spend more time walking, which could explain our finding (Althoff et al., 2017). Other researchers have also found high intakes of fruits and vegetables among Latino populations; Palacios et al., for example, recently found Mexican American and Puerto Rican American breast cancer survivors to consume diets rich in fruits, vegetables, and whole grains (Palacios et al., 2017). It is possible that the typical Hispanic/ Latina diet, especially among our primarily Dominican study sample, includes more produce compare to non-Hispanic populations.

With respect to acculturation, the only behavior where acculturation level statistically significantly differed was with added sugar intake; those less acculturated consumed more energy from sugar (8.91%) than did the more acculturated group (6.31%). This too, is not consistent with previous research, which has shown that less acculturated Hispanics consume more less sugar and sugar-sweetened beverages compared to their more acculturated or non-Hispanic counterparts (Ayala et al., 2008; Park, Blanck, Dooyema, & Ayala, 2016). However most studies have included Mexican or Puerto Rican Americans (Ayala et al., 2008), our population is uniquely, primarily Dominican.

We also found that women who had higher self-efficacy to eat less added sugar did consume less; a 1-unit increase in the self-efficacy for decreasing added sugar scale led to a decrease of 15.6% (p=0.002) added sugar intake, which is a clinically significant finding. Self-efficacy of participating in a target behavior has been associated with the target behavior among members of our demographic, and in national populations (Grenen, Kent, Hennessy, Hamilton, & Ferrer, 2017). Our research group previously, for example, found that both self-efficacy and dietary preferences mediated fruit and vegetable intake in this Hispanic, breast-cancer survivor population (Shi, et al., *in development*). While many interventions, apart from our previous work, are based in theoretical models and include self-efficacy and preferences as potential mediators when developing their studies, limited research is actually available to understand whether these determinants are actually related to, or mediate, the desired outcomes. More studies are needed to understand relationships between potential mediators, dietary intake, and physical activity among Hispanic/ Latina breast cancer survivors.

Further, our study found that women with higher mental health-related quality of life scores had higher total and targeted fruit and vegetable intakes, lower intakes of dietary fat, and participated in more minutes of daily physical activity. Research in this area generally focuses on general diet quality as discussed next: recent (2017) cross-sectional research found no association with quality of life and diet quality among breast cancer survivors (Orchard, Andridge, Yee, & Lustberg, 2017); however, other studies have found direct positive associations between diet quality an quality of life in Hispanic, non-Hispanic, and African American breast cancer survivors (Wayne et al., 2006). These analyses examined diet quality as a whole, e.g. with the Healthy Eating Index measure, whereas our associations are specifically targeted at specific food behaviors (Orchard et al., 2017). Our study therefore contributes to new,

specific insights, about how mental health-related quality of life may be related to specific behaviors of fruit and vegetable intake, dietary fat intake, and physical activity, especially among our Hispanic/ Latina, primarily Dominican, sample.

We found that participants had a 2.0% decrease in sugar intake per a 1-unit increased of Locus of control views of powerful others, and had a 1.0% increase in sugar intake with a 1-unit increase in stress level, which are clinically significant findings. Hispanic populations, especially those that are less acculturated, may be more vulnerable than their White counterparts with respect to domineering authority (Barker & Vasquez Guzman, 2015; Davidson et al., 2015). It's possible, therefore, that their concerns or lack of understanding about nutrition recommendations, including for sugar as suggested by our results, impede them from making healthful changes when prescribed by medical professionals, who can be considered in this case "powerful others". Stress has been associated with poor dietary patterns in a number of instances, including in systematic reviews; associations especially pronounced among women (Moore & Cunningham, 2012). While these studies typically focus on eating patterns overall, our study uniquely finds the association with added sugar and locus of control and stress.

Several limitations are to be considered in this study. First, recruitment of patients was performed in New York City, which may limit the generalizability of our findings. However, participants were recruited from northern areas of Manhattan, the Bronx, and Queens, thus increasing the representativeness of our sample. Second, the cross sectional nature of the study limits causal interpretations. Mediation analyses are able to suggest a chain of relationships, to show that a behavior is actually changed by a mediation variable; mediation analyses can better identify causal nature. Third, the possibility of a recall bias cannot be ruled out in self-reported data collection, making the findings of this study reliant on the accuracy of participants' self-

evaluation; it is difficult to know which direction results would change due to this bias. Nevertheless, the measures used in this study have been validated and assessed for reliability, emphasizing the high quality of our collected data. Assessments of our outcome behaviors are not without limitations as well, particularly regarding diet. While the 24-hour recall method is one of the most accurate measures of dietary assessment in real-world settings (Jonnalagadda et al., 2000), it is not without limitations as well. Researchers did make efforts to help participants relay diet accurately, however multiple studies have shown that adults routinely underestimate portion size (Almiron-Roig, Solis-Trapala, Dodd, & Jebb, 2013; Benton, 2015), and that social desirability often impacts dietary reporting (Hebert et al., 2008). Future studies may benefit from controlling for social desirability bias in Hispanic/ Latina populations (Di Noia et al., 2016). Finally, it is possible that the screening measures used to exclude participants with high fruit and vegetable intakes and physical activity levels were less robust than the 24-hour recall multiple pass method and the 7DPAR. Perhaps using these questionnaires as screening measures in future studies will identify those who need the most help improving their lifestyle behaviors.

Educational programs that target certain potential mediators and other psychological variables known to be related to specific health outcomes have been shown to improve these health outcomes to a greater extent than programs not guided by these factors (Contento, 2015). Advancing our understanding of these potential mediators and psychological variables can improve the development and success of interventions, especially among understudied populations like Hispanic/ Latina breast cancer survivors (Contento, 2015). Specifically, focusing on increasing self-efficacy of choosing foods low in added sugar, increasing their preference of low-fat foods, and including mental health-related quality of life and stress

management aspects of education in educational programs may improve these behaviors in our target group.

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# CHAPTER 5: DISCUSSION

## 5.1 Main Findings of This Study

This dissertation is a curriculum development project, aiming to improve lifestyle behaviors among Hispanic/ Latina breast cancer survivors, and an assessment of dietary and physical activity behaviors in this group. In addition to a behavioral assessment, potential psychosocial mediators of these specific behaviors are measured by a questionnaire, which was developed and analyzed for validity and reliability within our specific population. The studies in this dissertation were conducted within the context of a larger ongoing NCI-funded educational intervention study, *Mi Vida Saludable* (My Healthy Life), which aims to change diet and physical activity behaviors of Hispanic/ Latina breast cancer survivors. The parent study will examine the separate and synergistic effects of a) a group education program, and b) an e-communication program.

Three literature reviews were first conducted to inform the development of this *Mi Vida Saludable* educational intervention. The first review examined varying cancer survivor and common lifestyle-related disease dietary and physical activity guidelines. The resulting recommendations were used in the intervention development, which included increasing minutes of weekly moderate-to-vigorous physical activity to at least 30 minutes five days per week, increasing fruit and vegetable intake to at least 2 ½ cups, or five half-cup servings, each day, and decreasing dietary fat and sugar intake. The second review examined dietary and physical activity interventions that specifically targeted breast cancer survivors, and concluded that successful interventions included the use of Social Cognitive Theory. More literature was available for physical activity than diet or combined diet and activity programs; additional

research is needed to evaluate theory-based interventions for eating behaviors. Finally, the text message literature was reviewed as it pertains to weight management, dietary, and physical activity behaviors, specifically among Hispanic/ Latina populations, and indicated that text message interventions were more successful if they decreased in frequency over time, included specific educational advice, and had the ability for two-way communication.

While some interventions for breast cancer survivors target physical activity, very few target dietary change, and even fewer have developed education for Hispanic/ Latina groups. Therefore, the first study sought to develop an intervention, *Mi Vida Saludable,* to test the mode of education, either group education or online education, with the 6-step DESIGN procedure: 1. ***D***ecide behaviors; 2. ***E***xplore determinants or potential mediators of change; 3. ***S***elect theory; 4. ***I***ndicate objectives; 5. ***G***enerate plans; and 6. ***N***ail down evaluation). Using this procedure ensures that programs are developed that are theory-based and behaviorally focused. The framework is structural so that it is easy to follow and can be replicated in other populations. The resulting group education program consisted of four, four-hour weekly sessions with hands-on, culturally tailored activities. The resulting corresponding online education program consisted of 11 months of emails, text messages, and newsletters.

A survey instrument was developed to assess two key psychosocial potential mediators of behavior change from Social Cognitive Theory, preferences and self-efficacy, separately for each targeted behavior. Expert panel review assessed scale validity by Content and Face Validity. Participants from the target population assessed scale validity and reliability by 1) content validity by cognitive interviewing, 2) convergent validity, 3) internal consistency reliability, and 4) test-retest reliability. Content and face validity, and cognitive interviews successfully improved the questionnaire before quantitative analysis. Modifications from content and face

validity included the addition of pictures of fruits and vegetables and the addition of examples of different food types high in fat and added sugar. Results from the cognitive interviews indicated primarily that changes to examples of foods with and without dietary fat and added sugar in the questionnaire should be made. Internal consistency and test-retest reliability results were fairly robust. Cronbach alpha values, assessing internal consistency reliability, were sufficient for all *Preferences* and *Self-efficacy* scales except for the *Preferences* scale for added sugar intake. Item-total correlations were sufficient for all reduced *Preferences* and *Self-efficacy* scales. Test-retest reliability, assessed by ICC values, proved sufficient for all *Preferences* and *Self-efficacy* reduced scales except for *Preferences* of dietary fat intake.

Last, psychosocial potential mediators and measures of quality of life were examined in a cross sectional study of *Mi Vida Saludable* participants as they relate to diet and physical activity behaviors. Outcome variables included diet, specifically servings of fruits and vegetables (both total and varieties specifically targeted by the intervention), and percent dietary fat and added sugar of the diet, as well and average minutes of physical activity per week. Results of multiple regression models indicated that typical behaviors for this group included consuming the recommended amount of servings of fruits and vegetables, consuming dietary fat and added sugar within the Dietary Reference Intakes (DRI) from the US Institutes of Medicine (IOM) recommended levels, and participating in the recommended minutes of weekly moderate to vigorous physical activity. With respect to acculturation, the only target behavior where acculturation level significantly differed was with added sugar intake; those less acculturated consumed more energy from sugar than did the more acculturated group. We also found that women who had increased self-efficacy to eat less added sugar did consume less; and women with increased preferences for foods low in dietary fat did eat less fat. Further, our study found

that women with higher mental quality of life scores had higher total and targeted fruit and vegetable intakes, lower intakes of dietary fat, and participated in more minutes of daily physical activity.

## 5.2 Contributions to the Literature and Implications for Future Research

The present dissertation describes the development of theory-based curricula, the development of a corresponding psychosocial potential mediator questionnaire, and an assessment of baseline behaviors and corresponding potential mediators among women participating in the first three cohorts of *Mi Vida Saludable.* In doing so, this dissertation presents a detailed and practical account of the process from understanding the educational needs and gaps of our target audience, to being able to describe their behaviors using valid and reliable measures as dictated by our detailed and organized approach.

### 5.2.1 Paper 1: Contributions to the Literature and Implications for Future Research

The development of some, albeit few, educational programs for breast cancer survivors, and for relatively small groups, are described in such detail as the current study. There are a number of systematic processes for designing programs in the health education domain. RE-AIM, *R*each, *E*fficacy or *E*ffectiveness, *A*doption, *I*mplementation, and *M*aintenance, aims combine both internal and external validity to translate research into practice (Glasgow, Lichtenstein, & Marcus, 2003; Glasgow, Vogt, & Boles, 1999), and PRECEDE-PROCEED (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation; Policy, Regulatory, and Organizational Constructs in Educational and Environmental

Development), posits that health behavior is influenced by both individual and environmental factors (Green LW, 1991; Phillips, Rolley, & Davidson, 2012). However, both of these frameworks do not provide guidance for actual development of group education or materials, and are more useful for community-level projects than smaller group education programs, classroom-based or online. The DESIGN procedure however, used to develop *Mi Vida Saludable*, focuses on education aimed at both individual-level potential mediators of change as well as individuals' actual behaviors (Contento, 2015).

Few studies for individuals and small audiences have described in detail their programs' development, and, in particular, among Hispanic/ Latina groups or with cancer survivors. *Cocinar Para Su Salud*, on which *Mi Vida Saludable* is based, is described in detail in a methods paper using the 6-Step DESIGN procedure described in detail (Aycinena et al., 2016). As mentioned, *Cocinar Para Su Salud,* is a theory-based, behaviorally-focused group-based education program aimed to help Hispanic/ Latina breast cancer survivors increase their fruit and vegetable intake and decrease their fat intake, which was successful in achieving the former (Aycinena et al., 2016). *Mi Vida Saludable* builds on this DESIGN framework by focusing on additional behaviors (increasing physical activity and decreasing added sugar intake) and adding an online component. Outside our immediate research group, few studies have described the DESIGN procedure for academic publication. One manuscript under review describes a group-based after-school educational program for middle school students based on Michael Pollan's published works. Another intervention using the social media platform Instagram is also under review, targeting reducing late-night eating of energy-dense foods at night among college students (Paul et al., 2016).

This curriculum is the first to be developed in manuscript form for publication for parallel group-based and online-based education programs for our target population, Hispanic/ Latina breast cancer survivors. One of the most important benefits of describing an intervention in such detail for publication is that researchers and practitioners can follow the step-by-step process of DESIGN to tailor education programs to their populations' needs. Both the description of the DESIGN procedure, as well as clear examples of how to put the 6 Steps into practice for both group-education and online education, have the potential to be incredibly useful to others. When educational programs are developed without describing their methodological procedures on the other hand, which is often the case, replication and identification of effective strategies is difficult, and often impossible. In order to improve intervention efficacy, avoid duplicating efforts, and maximize time and financial resources, it is imperative for researchers to clearly describe their methodologies for the benefits of others.

Future interventions should describe their intervention development methods in detail, preferably using a systematic process such as DESIGN, to improve reproducibility and scalability of potential programs. As resources and funding become increasingly difficult to acquire, it is necessary for researchers and interventionists to efficiently learn from others' mistakes and successes. Future studies as well, should aim to replicate others' success, by examining methods manuscripts and outcomes manuscripts in tandem. More research is needed in a number of areas. First, as limited research is available describing the DESIGN process, researchers should explain their methods of developing educational interventions in methods papers, on a broad scale. Reporting interventions accurately is critical for other researchers and practitioners to implement and replicate. Researchers can use the Template for Intervention Description and Replication (TIDieR) checklist and guide for consistency (Hoffmann et al.,

2014). Second, these methods are especially needed in more vulnerable populations, such as Latinas. Finally, an increasing number of researchers are using online and phone-based methods for educational purposes, as these mediums are more cost-effective than in-person programs. It is important to continue to use DESIGN to develop electronic-based education programs using a variety of modes including, but not limited to: social media, text messaging, smart phone applications or "apps", email marketing, etc.

### 5.2.2 Paper 2: Contributions to the Literature and Implications for Future Research

Further, few studies describe in detail the development of a potential mediator questionnaire and the description of validity and reliability methods to assess such a questionnaire, especially among Hispanic/ Latina groups and cancer survivors. Some research to test validity and reliability of potential mediator questionnaires for exists, especially for self-efficacy, specific for dietary behaviors among children (Gray et al., 2016; Hernandez-Garbanzo, Brosh, Serrano, Cason, & Bhattarai, 2013), and physical activity behaviors among children and adults, and for adults with certain diseases, e.g. heart disease (Borges, Rech, Meurer, & Benedetti, 2015; Liang, Lau, Huang, Maddison, & Baranowski, 2014; Voskuil, Pierce, & Robbins, 2017). However, very little research has been conducted to understand other psychosocial potential mediators, such as preferences, and to understand these potential mediators as they relate to the behaviors of dietary fat intake and added sugar intake. Further, very little work is published to validate and test for reliability of these types of measures in Hispanic/ Latina populations.

As discussed, Hispanic populations are at greater risk of cancer recurrence compared to non-Hispanic Whites which may be due to poor access to medical services (Adams, Barnes, &

Vickerie, 2008), high rates of diabetes and obesity (Hedley et al., 2004), and lower rates of physical activity (Schoenborn & Heyman, 2009). With *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas,* we should be able to identify which variables do in fact mediate our intervention and the outcome behaviors with the ability to accurately assess potential mediators of preferences and self-efficacy of our key behaviors. We can therefore improve our future interventions with this knowledge, by focusing on those potential mediators that do in fact impact our target behaviors.

Future research should first test *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* in other Hispanic/ Latina populations for validity and reliability, as our study is limited to a primarily Dominican group in New York City. Additionally, cognitive interviews with a larger sample size than ours (n>4), may help identify any potential problems with *Preferences* scales for fat and sugar in our specific population, as well as any potential problems with other Hispanic/ Latina groups. As very few questionnaires have been developed to understand potential mediators for dietary fat and added sugar behaviors. *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* it may also beneficial to adapt this questionnaire for other, non-Latina populations.

### 5.2.3 Paper 3: Contributions to the Literature and Implications for Future Research

Our participants consumed the recommended amount of servings of fruits and vegetables, and participated in the recommended minutes of weekly moderate to vigorous physical activity based on AICR/ ACS guidelines. However, previous studies have indicated that US cancer survivors do not consume the five daily servings of fruits and vegetables, eat less than 30% of calories from fat, nor meet physical activity guidelines (Blanchard, Courneya, Stein, & American

Cancer Society's SCC-II, 2008; Coups & Ostroff, 2005; Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000; Inoue-Choi, Robien, & Lazovich, 2013; Kimmons, Gillespie, & Michels Blanck, 2009; McBride, Clipp, Peterson, Lipkus, & Demark-Wahnefried, 2000). Our findings therefore are an important contribution to understand breast cancer survivor behaviors. Future research should identify why Hispanic/ Latina breast cancer survivors, perhaps specifically primarily Dominican populations living in New York City, are different from the general American population. It is possible that New York City is a unique location, as healthful eating education programs are numerous and available for many low income and underserved populations. In addition, those living in cities are more likely to spend more time walking, which could explain our finding (Althoff et al., 2017). It may also be insightful to compare the health behaviors of those in New York City to those in other cities, suburbs, and rural areas, to determine if this city is a uniquely healthy location; and, it may be interesting to identify whether certain demographic groups of individuals within New York City itself follow dietary and physical activity guidelines more than others. Education programs can vary their approaches based on these findings, by targeting different health behaviors.

Analyses of regression models statistically significantly indicated that there was an association with increased self-efficacy to eat less added sugar and decreased added sugar intake. A 1-unit increase in the *Self-efficacy* for decreasing added sugar scale was associated with a decrease of 15.6% (p=0.002) added sugar intake. As this scale is a five-point scale, i.e. not a larger seven- or nine-point Likert-type scale, and as the IOM recommends that dietary fat consume 20-35% of dietary calories, this result may be clinically significant. Ideally, *Mi Vida Saludable* will be able to increase participants' confidence to choose foods lower in dietary fat.

Future interventions should focus on self-efficacy when developing and evaluating educational programs among Hispanic/ Latina groups.

Further, our study found that higher mental quality of life scores were statistically significantly associated with higher intakes of total (1.01) and targeted (1.02) servings of fruit and vegetables and participated in 1.2 more minutes of daily physical activity. Similar to the effect of self-efficacy, these results are clinically significant especially for fruit and vegetable intakes, as well as statistically significant, as the recommended number of servings of fruits and vegetables is five. As *Mi Vida Saludable* does not include education on mental health quality of life, nor is it typically included in the 6-step DESIGN Procedure, it may be important for future interventions to include education on improving mental health quality of life. This may be especially important for the behavior of increasing fruit and vegetable intake, more than physical activity. Perhaps the best place for this variable is in Steps 2 and 3 of DESIGN; when identifying potential mediators and a corresponding psychosocial theory. While mental health quality of life is not a typical potential mediator, it's possible that this factor has an important place in nutrition and physical activity education. Finally, as the NIH hopes for researchers to implement PROMIS across studies to better compare psychosocial metrics across multiple populations, our results also contribute to this growing body of literature as well (Broderick, DeWitt, Rothrock, Crane, & Forrest, 2013; Jensen et al., 2015).

## 5.3 Strengths

There are many strengths of this study. One strength is the application of a systematic framework for the development of *Mi Vida Saludable*'s group and online education programs.

Interventions have shown to be more effective if they are behaviorally-focused, theory-based, and use associated potential mediators to guide the development of the program (Contento, 2015; Katz, O'Connell, Njike, Yeh, & Nawaz, 2008). DESIGN allows developers to create a theory-based model and specific potential mediators that have been shown to influence a certain behavior for the target group (Contento, 2015). By using the DESIGN framework, our work here contributes to the emphasis on methodological manuscript submissions in nutrition and physical activity education. Further, as there are not published guidelines for developing culturally-tailored educational programs among racial/ ethnic minority populations, and there are therefore limited resources for Hispanic/ Latina groups. *Mi Vida Saludable* was developed to help Hispanic/ Latina women feel connected in terms of language and community, which has been shown as a strong desire among this group (Castro, Barrera, & Holleran Steiker, 2010).

*Mi Vida Saludable* is based on the previously developed intervention, *Cocinar Para Su Salud*. As *Cocinar Para Su Salud* achieved statistically significant success in improving dietary behaviors (Greenlee et al., 2015), we can be more confident that *Mi Vida Saludable* will have beneficial effects with the same general population. Other researchers can use the detailed descriptions of both *Cocinar Para Su Salud* and *Mi Vida Saludable* to inform their own intervention development. Further, the detailed description of the development of the electronic education component of *Mi Vida Saludable* is a unique strength; as it was developed in tandem with a corresponding group education program.

Another strength is the consideration for evaluation requirements in the planning phases of *Mi Vida Saludable*, and the systematic measures taken to create and evaluate our potential mediator questionnaire, *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas*. The questions are specifically targeted to our population so

that we may be able to detect reasons for changes in behaviors after *Mi Vida Saludable*. However, the development of the potential mediator questionnaire was based on previously validated surveys; the physical activity and fruit and vegetable scales were based on previously validated surveys with cancer survivors and an adult population mirroring the US population, respectively. This basis bolsters the validity and reliability of our questionnaire, and the possibility that our questionnaire can be tailored for other groups, i.e. demographic groups and/ or those who are not cancer survivors. In addition, the final, reduced questionnaire is brief, about 10 minutes, and is easy to administer. The benefit of this reduction is the potential cutback of participant fatigue.

Finally, as not many questionnaires to measure self-efficacy and preferences of our target behaviors are described in the literature, our regression models predicting behaviors with our validated and reliable potential mediator questionnaire, *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas,* can be considered more robust. Further, our behaviors were measured with 24-hour recalls using the comprehensively validated tool NDSR from the University of Minnesota, and the 7DPAR, also validated extensively with Hispanic/ Latina populations (Greenlee et al., 2015; Keller et al., 2014; Kieffer et al., 2014; Rauh, Hovell, Hofstetter, Sallis, & Gleghorn, 1992; Schneiderman, Chirinos, Aviles-Santa, & Heiss, 2014).

## 5.4 Limitations

These manuscripts are not without limitations. First, recruitment of patients was performed in New York City, which may limit the generalizability of our findings. However,

participants were recruited from around the city, including areas of Manhattan, the Bronx, and Queens thus increasing the representativeness of our sample. Second, the study sample size of n=30 is the minimum recommended for test-retest reliability (Bolarinwa, 2015); future studies could replicate our analyses of *The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* with additional subjects in our specific population and with other Hispanic/ Latina breast cancer survivors.

Generally, the possibility of recall bias cannot be ruled out in self-reported data collection, making the findings of this study reliant on the accuracy of participants' self-evaluation. Nevertheless, the measures used in this study have been validated and assessed for reliability, emphasizing the high quality of our collected data. The cross sectional nature of the study limits causal interpretations. Mediation analyses are able to suggest a chain of relationships, to show that a behavior is actually changed by a mediation variable; mediation analyses can better identify causal nature. Finally, it is possible that the screening measures used to exclude participants with high fruit and vegetable intakes and physical activity levels were less robust than the 24-hour recall multiple pass method and the 7DPAR. Perhaps using these questionnaires as screening measures in future studies will identify those who need the most help improving their lifestyle behaviors.

## 5.5 Future Directions

### 5.5.1 Implications for Research

The DESIGN Procedure is helpful for researchers knowledgeable in psychosocial theories and behavior change techniques. It's possible that a shortened version of DESIGN with

instructions and descriptions, can be developed and tested for efficacy compared to Contento's textbook version. In addition, financial resources and funding methods are increasingly difficult to obtain. Other electronic methods should be considered and studied for efficacy among Hispanic/ Latina populations to change lifestyle-related behaviors, as these often require less financial and fewer personnel resources. Examples may include: text messaging, social media, emails, forums, group online chats with video, etc.

*The Preferences and Self-Efficacy of Diet and Physical Activity Behaviors Questionnaire for Latinas* should be adapted for other Latina/ Hispanic populations, as our sample was primarily Dominican and confined to those residing in New York City. For example, Latina/ Hispanic groups have different names for certain vegetables and fruits. In addition, after adapting the questionnaire for different groups, the questionnaire should be assessed for reliability and validity, using the methods discussed in Chapter 3. In addition, if resources allow, questionnaires should be developed to assess other potential mediators within Social Cognitive Theory, in addition to preferences and self-efficacy examined in this dissertation.

Finally, it will be important to further understand relationships between potential mediators, self-efficacy and preferences, and our key lifestyle-related behaviors of diet and physical activity. Chapter 4 identified that these relationships were not profound in our population, which warrants further investigation. It may also be important to assess whether other potential mediators within Social Cognitive Theory, in addition to self-efficacy and preferences, are related to our target outcomes. Further, as the relationship between quality of life and our specific diet and physical activity behaviors is a new finding in this dissertation, additional research should seek to understand any causal nature with these variables.

### 5.5.2 Implications for Practice

Some practitioners who do not have proper training in these methods may not understand the DESIGN Procedure. It's possible that the shortened version of DESIGN described above can be used by practitioners in nutrition education settings. This potential resulting manual may be most helpful in low-income and racial/ ethnic minority populations, such as other Hispanic/ Latina groups outside of New York City, where resources and time for nutrition education are likely limited.

In addition, practitioners and nutrition educators should be aware of the many factors that influence dietary and physical activity behaviors, including potential mediators studied here, but also other factors such as quality-of-life. Continuing education courses, such as through the Academy of Nutrition and Dietetics or the Society for Nutrition Education and Behavior may be one of the best ways to learn about new relationships between these types of factors and our target behaviors, and how to handle them in a practitioner's setting.

## 5.6 Conclusion

This dissertation consists of three studies: a methodological description on the development of a theory-based, behaviorally focused intervention with classroom and online education curricula; an empirical validation study of a survey instrument; and a cross sectional study of women's diet and physical activity behaviors and theory-based determinants. These studies can inform future educational interventions by using our culturally-tailored, theory-based, behaviorally-focused model as a framework and by using our validated assessment tools. These

studies can also inform future educational interventions by understanding diet and physical activity behaviors and related potential mediators.

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# APPENDIX A. SUPPLEMENTAL TABLES (CHAPTER 2)

## Table 6. Outline of Group Education Component for *Mi Vida Saludable*

| Potential Mediators | Strategy | Specific Objectives<br>Participants will be able to… | Activity |
|---|---|---|---|
| **Introduction**<br>10-30 minutes<br>*Overview of Mi Vida Saludable Program*<br>*Overview of AICR/ ACS Guidelines* | | | |
| Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Provide factual information about benefits and scientific evidence supporting engaging in the target behavior changes |
| Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Provide striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Review of Goal Setting Plans**<br>0-10 minutes<br>*Lesson 2: Review increasing physical activity goals*<br>*Lesson 3: Review increasing fruit and vegetable goals*<br>*Lesson 4: Review decreasing dietary fat goals* | | | |
| Goal Intention/ Goal Setting | Monitoring action/ goal setting plans | State any changes to goal intentions | Discussion of previous action plans making modifications if necessary |
| Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment | Create supportive group environments |
| **Physical Activity Education**<br>30-60 minutes<br>*Lesson 1 Focus: Increasing physical activity at home*<br>*Lesson 2 Focus: Increasing recreational time physical activity*<br>*Lesson 3 Focus: Increasing physical activity as transportation*<br>*Lesson 4 Focus: Decreasing sedentary time* | | | |
| Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Provide factual information about benefits and scientific evidence supporting engaging in the target behavior changes |
| Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience. |
| **Nutrition Education**<br>20-60 minutes<br>*Lesson 1 Focus: Decrease dietary fat & added sugar intake*<br>*Lesson 2 Focus: Increase fruit and vegetable intake*<br>*Lesson 3 Focus: Decrease dietary fat & added sugar intake; increase fruit and vegetable intake*<br>*Lesson 4 Focus: Decrease dietary fat & added sugar intake; increase fruit and vegetable intake* | | | |
| Outcome Expectations (positive): Perceived Benefits | Provide information about positive outcomes of target behavior | Demonstrate increased knowledge of benefits of following AICR/ ACS recommendations | Provide factual information about benefits and scientific evidence supporting engaging in the target behavior changes |
| Outcome Expectations (negative): Perceived Threat/ Risks | Provide information about negative outcomes of not performing target behavior | Evaluate personal risk of negative outcomes of not performing target behaviors | Provide striking statistics and other information about personal risk of negative outcomes of not performing target behaviors |
| **Additional Interactive Nutrition Education Activities**<br>0-45 minutes<br>*Lesson 3: Guided tour of supermarket*<br>*Lesson 4: Guided tour of farmers' market* | | | |
| Behavioral Capability | Provide active mastery experiences/ guided practice | Demonstrate increased knowledge and skills of buying F&V, foods low in fat and added sugar | Demonstration of skills followed by guided practice with feedback |
| Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience. |
| **Cooking**<br>60-90 minutes<br>*Lesson 1 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake*<br>*Lesson 2 Focus: Cooking methods and recipes to increase fruit and vegetable intake*<br>*Lesson 3 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake; and to increase fruit and vegetable intake* | | | |

| | | | |
|---|---|---|---|
| *Lesson 4 Focus: Cooking methods and recipes to decrease dietary fat and added sugar intake; and to increase fruit and vegetable intake* | | | |
| Behavioral Capability | Provide active mastery experiences/ guided practice | Cook foods with lower fat and added sugar and more fruits and vegetables | Demonstration of food preparation/ cooking skills followed by guided practice with feedback through hands-on activities to develop cooking skills |
| Self-efficacy | Provide guided practice | View the behavior as easy to understand and complete | Assist individuals to achieve success by providing clear instructions, demonstrating behavior, providing practice or direct experience |
| **Goal Setting**<br>15 minutes<br>*Lesson 1: Create increasing physical activity goals*<br>*Lesson 2: Create increasing fruit and vegetable goals*<br>*Lesson 3: Create decreasing dietary fat goals*<br>*Lesson 4: Create decreasing added sugar goals* | | | |
| Perceived Barriers | Prompt identification of perceived barriers | Identify barriers | Group brainstorms barriers to goal behaviors and ways to overcome barriers |
| Goal Intention/ Goal Setting | Stimulate action goal setting | State goal intentions and create goals | Teach goal setting skills for specific behaviors or actions, provide action planning forms |
| **Communal Meal**<br>15 minutes | | | |
| Taste Preferences | Provide direct experience with healthful food | Consume foods low in fat and added sugar and high in fruits and vegetables | Eating meal together |
| Social Support | Enhance skills in management of social context | Evaluate class context as a supportive environment for making positive health behavior changes | Create supportive group environments. |